SOIL SURVEY OF

Box Elder County, Utah

Eastern Part

United States Department of Agriculture
Soil Conservation Service and
United States Department of the Interior
Fish and Wildlife Service
Bureau of Land Management
In cooperation with
Utah Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1964–68. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1969. This survey was made cooperatively by the Soil Conservation Service, the Fish and Wildlife Service, the Bureau of Land Management, and the Utah Agricultural Experiment Station. It is a part of the technical assistance furnished to the Northern Utah, the South Box Elder, and the West Box Elder Soil Conservation Districts.

Copies of the soil map in this publication can be made by commercial photographers or can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Box Elder County, Utah, Eastern Part, contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Box Elder County, Eastern Part, are shown in the detailed map at the back of this soil survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all the soils of the survey area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit or units and the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the range sites.

Ranchers and others can find, under "Use and Management of the Soils for Range," groupings of the soils according to their suitability for range and the names of many of the plants that grow on each range site.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use and Management of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Soils for Recreational Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to Box Elder County, Eastern Part, may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "Additional Facts About Box Elder County, Eastern Part."

***Cover:* Nonirrigated grain stubble on DeJarnet gravelly silt loam, 1 to 6 percent slopes, in Blue Creek Valley.**

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SOIL SURVEY OF BOX ELDER COUNTY, UTAH, EASTERN PART

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BOX ELDER COUNTY, EASTERN PART (also called the survey area in this publication) is in the extreme north-central part of Utah (fig. 1) and takes in the entire eastern part of Box Elder County.

The survey area is bounded on the north by the State of Idaho; on the east by Cache County; on the south by Weber County and Great Salt Lake; and on the west by the remaining part of Box Elder County. The total area of the survey is 1,259,278 acres, or about 1,968 square miles. The entire area is in Box Elder County except for Fremont Island, which is in adjoining Weber County. This island is 2 miles offshore from the southern tip of Promontory Point. Fremont Island, which is about 1 square mile in size, is the third largest island in the Great Salt Lake. Brigham City, having a population of 14,000, is the largest city in the survey area and is the county seat. It is situated at the base of the Wasatch Mountains, 60 miles north of Salt Lake City.

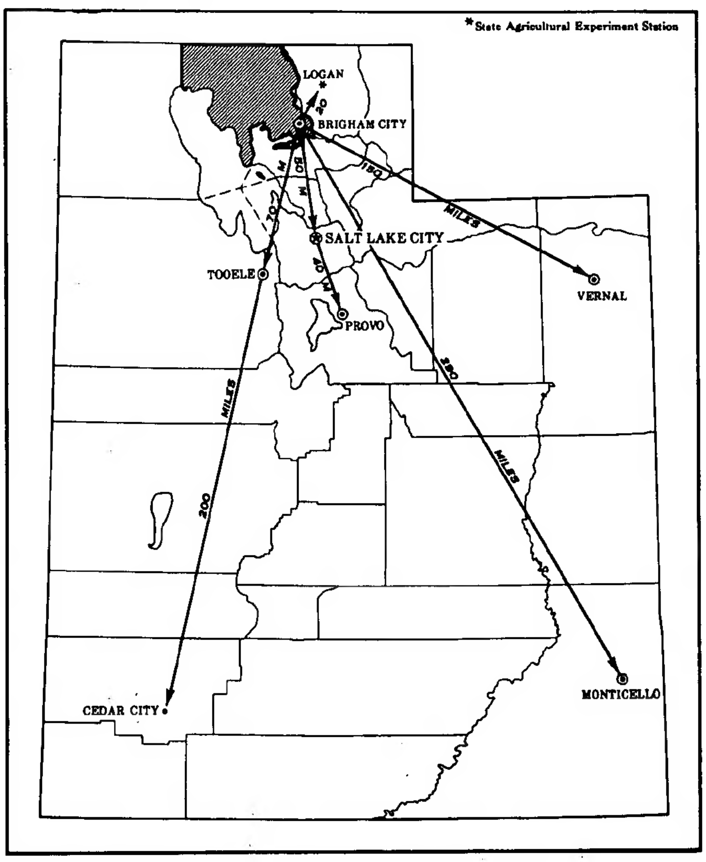

Figure 1.—**Location of Box Elder County, Eastern Part, in Utah.**

The survey area consists of a series of gently sloping terraces and alluvial fans and of rolling uplands and mountains. Except for the mountainous land, a large part of the area was covered by ancient Lake Bonneville, a freshwater lake. Along the mountain sides and on alluvial fans are shore features consisting of terraces, beaches, and bars that were formed by this lake. The alkali flats and desert areas that are so prominent in this area represent the floor of the ancient lake. Elevation ranges from about 4,200 feet along the shores of Great Salt Lake to about 8,900 feet in the high mountains. The precipitation varies generally with the elevation. At 4,200 feet above sea level, the precipitation is about 7 inches, but it ranges to near 30 inches annually in the high mountains. The area is drained into Great Salt Lake through numerous small drainageways. Two major rivers enter the area from Idaho.

The irrigated cropland is concentrated in the eastern part of the survey area. The irrigated soils occur on the low terraces and flood plains in Bear River Valley and the alluvial fans along the mountain front. This irrigated cropland occupies about 86,000 acres. There is a plentiful supply of high-quality irrigation water, which is delivered by a system of canals 120 miles long. The area is very important agriculturally and ranks high in the production of farm crops. Crops commonly grown are sugar beets, alfalfa, small grain, tomatoes, corn for silage, and some celery, onions, peas, and bush beans. The area has the largest acreage of sugar beets in the State. It is widely acclaimed for the fruit orchards along the mountain front, where peaches, cherries, apples, apricots, and some melons and sweet corn are grown. Killing frosts are common in the fruit-producing area.

Beef is the principal livestock product. Dairy and poultry products and turkeys are also produced in quantity, since feed grains are plentiful.

The nonirrigated cropland is mainly in the north-central part of the survey area and is on gently sloping

terraces and rolling uplands. About 238,000 acres are used for nonirrigated crops, the highest acreage of any county in the State. Wheat is the principal crop.

The mountainous lands and areas of precipitation less than that needed for nonirrigated farming make up the range. Juniper-covered areas have little value as woodland and therefore are considered range. Wide extremes of climatic factors and elevations affect the range vegetation. The per-acre production varies from only a little plant growth near the shores of Great Salt Lake to abundant growth in the high mountains. Cattle production is a major source of agricultural income.

The small communities along the mountain front, along with Brigham City, have grown in population during the last decade.

Tremonton, in the heart of the irrigated valley, had a population of 2,974 in 1970, an increase of 38 percent over its 1960 population. Small communities in other parts of the survey area have declined in population during the last decade.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Box Elder County, Eastern Part, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Hansel and Thiokol, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, salinity, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Hansel silt loam, 1 to 6 percent slopes, is one of several phases within the Hansel series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this survey was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of more than one series or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Box Elder County, Eastern Part: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Pasleys-Munk complex, 10 to 20 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Broad-Middle association, steep, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties,

together with available research data, to predict limitations or suitability of soils for present or potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map[1]

The general soil map at the back of this survey shows, in color, the soil associations in Box Elder County, Eastern Part. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a survey area, who want to compare different parts of a survey area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or other structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey area have been grouped into five general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in each group are described in the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer of the major soils. For example, in the title of association 1, the words, "silt loams, gravelly loams, and very stony loams" refer to the texture of the surface layer.

Well-Drained and Somewhat Excessively Drained Soils of the Mountains

These soils are on mountain slopes and alluvial fans in the mountains and high mountains. They are silt loams, gravelly loams, and very stony loams that formed in residuum, colluvium, and alluvium derived from quartzite, sandstone, and limestone.

Elevations of these soils are 5,200 to 8,000 feet. The average annual precipitation is 18 to 26 inches. The mean annual temperature is 40° to 47° F., and the frost-free season is 60 to 100 days. These soils are used for range, wildlife habitat, and water supply.

One association of Box Elder County, Eastern Part, is in this group. It makes up about 2 percent of the survey area.

[1] LUDENE CAMPBELL, soil scientist, Soil Conservation Service, assisted in preparing this section.

1. Foxol-Elzinga-Agassiz association

Well-drained and somewhat excessively drained, very steep silt loams, gravelly loams, and very stony loams; on mountains and alluvial fans

This association is mainly in scattered locations along the eastern border of the survey area. The soils formed in residuum, colluvium, and alluvium derived from quartzite, sandstone, and limestone. Slopes are 25 to 70 percent. The vegetation is bluebunch wheatgrass, buckwheat, low sagebrush, sugar balsamroot, and annual weeds on the Foxol and Agassiz soils, and it is maple, chokecherry, snowberry, western cornflower, mountain brome, and bearded wheatgrass on the Elzinga soils. Elevations are 5,200 to 8,000 feet. The average annual precipitation is 18 to 26 inches. The mean annual temperature is 40° to 47° F., and the frost-free season is about 60 to 100 days.

This association makes up about 2 percent of the survey area. It is about 25 percent Foxol soils, 25 percent Elzinga soils, and 20 percent Agassiz soils. Small areas of Picayune, Richmond, Ridd, and Middle soils under a cover of grass and maple, Lucky Star soils under a cover of aspen, and Bickmore soils under a cover of Douglas-fir make up the remaining 30 percent of the association.

The Foxol soils are somewhat excessively drained and are 14 to 20 inches deep to quartzite bedrock. The surface layer and subsoil are brown gravelly loam. The substratum is very gravelly loam that is underlain by quartzite bedrock.

The Elzinga soils are well drained and are more than 60 inches deep. The surface layer is very dark gray silt loam and loam, the subsurface layer is pale-brown very gravelly silt loam, and the subsoil is light-brown gravelly clay loam.

The Agassiz soils are somewhat excessively drained and are 14 to 19 inches deep to limestone. The surface layer is brown very stony loam and very cobbly loam. The next layer is yellowish-brown very cobbly loam that is underlain by limestone bedrock.

The major soils in this association are used as range for cattle and sheep. They are also valuable as wildlife habitat and watershed. Big-game animals and upland birds thrive on the soils of this association. Rocky Mountain bighorn sheep have recently been introduced into this area.

Well-Drained Soils of the Mountain Foot Slopes, High Fans, and Terraces

These soils are mainly on mountain foot slopes and associated alluvial fans and high lake terraces. They are silt loams and loams that are cobbly in some areas. The soils formed in residuum and colluvium derived from sandstone, limestone, basalt, and quartzite and in alluvium derived from sandstone, limestone, and quartzite.

Elevations of these soils are 4,800 to 7,000 feet. The average annual precipitation is 15 to 21 inches. The mean annual temperature is 42° to 50° F., and the frost-free season is 75 to 130 days. These soils are used for nonirrigated crops, range, wildlife habitat, and water supply.

Two associations of Box Elder County, Eastern Part, are in this group. They make up 14 percent of the survey area.

2. Middle-Broad association

Well-drained, gently sloping to very steep cobbly silt loams and cobbly loams; on mountain foot slopes

This association is mainly in low, mountainous areas of the Malad River and between Blue Creek and Hansel Valleys in the northern part of the survey area. The soils formed in residuum and colluvium derived from sandstone, limestone, basalt, and quartzite. Slopes are 10 to 70 percent. The vegetation is dominantly bluebunch wheatgrass, sagebrush, bitterbrush, Sandberg bluegrass, snowberry, and annual grasses. Elevations are 4,800 to 6,600 feet. The average annual precipitation is 15 to 19 inches. The mean annual temperature is 42° to 48° F., and the frost-free season is 75 to 100 days.

This association makes up about 11 percent of the survey area. It is about 60 percent Middle soils and 30 percent Broad soils. The Gemson and Snowville soils are minor soils and make up the remaining 10 percent of the association.

The Middle soils have a surface layer of grayish-brown cobbly silt loam, a subsoil of brown very cobbly silt loam, and a substratum of very pale brown very cobbly loam. Limestone bedrock is at a depth of 24 to 38 inches.

The Broad soils have a surface layer of dark grayish-brown cobbly loam, a subsoil of brown gravelly clay loam, and a substratum of very pale brown very gravelly heavy loam. Fractured sandstone bedrock is at a depth of 30 to 40 inches.

The soils in this association are used for range, wildlife habitat, and water supply. They are a source of valuable habitat for upland game birds.

3. Hendricks-Forsgren-Manila association

Well-drained, gently sloping to very steep silt loams and loams; on foothills, alluvial fans, and high lake terraces

This association is mostly in mountain valleys near Mantua in the southeastern part of the survey area and near Pocatello Valley and Whites Valley in the northeastern part. The soils formed in residuum, colluvium, and alluvium derived from sandstone, quartzite, and limestone. Slopes are 1 to 20 percent on the Hendricks and Forsgren soils and 6 to 60 percent on the Manila soils. The vegetation is dominantly bluebunch wheatgrass, big sagebrush, Great Basin wildrye, serviceberry, yarrow, and annual grasses but includes other grasses and shrubs. Elevations are 4,900 to 6,800 feet. The average annual precipitation is 16 to 21 inches. The mean annual temperature is 42° to 50° F., and the frost-free season is 85 to 130 days.

This association makes up 3 percent of the survey area. It is about 20 percent Hendricks soils, 20 percent Forsgren soils, and 20 percent Manila soils. The Parleys, Goring, Yeates Hollow, Red Rock (high rainfall), Gemson, Obray, and Smarts soils are minor soils and make up the remaining 40 percent of the association.

The Hendricks soils have a surface layer of dark grayish-brown silt loam and a subsoil of grayish-brown, brown, and light yellowish-brown silty clay loam. These soils are more than 60 inches deep.

The Forsgren soils have a surface layer of dark grayish-brown heavy silt loam, a subsoil of brown and light-brown silty clay loam and silty clay, and a substratum of light-brown silt loam. These soils also are more than 60 inches deep.

The Manila soils have a surface layer of dark grayish-brown loam, a subsoil of grayish-brown silty clay loam, grayish-brown and brown silty clay, and light-brown clay, and a substratum of very cobbly silt loam. These soils are 50 to 60 inches deep to weathered sandstone and fractured limestone bedrock.

These soils are used for nonirrigated crops, range, wildlife habitat, and water supply. Upland game birds are found on this association.

Moderately Well Drained to Somewhat Excessively Drained Soils of the High, Medium, and Low Lake Terraces and Fans

These soils are mainly on lake terraces, alluvial fans, and associated mountains and foot slopes. They are silt loams, loams, and sandy loams that are cobbly or gravelly in some areas. The soils formed mostly in alluvium and colluvium derived from sandstone, quartzite, limestone, and some gneiss, schist, and lake sediments. A few soils formed in residuum derived from sandstone, quartzite, and limestone.

Elevations of these soils are 4,220 to 6,800 feet. The average annual precipitation is 8 to 18 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 100 to 160 days. These soils are chiefly used for nonirrigated crops, range, wildlife habitat, and water supply. Small areas are used for irrigated crops and urban developments.

Five associations of Box Elder County, Eastern Part, are in this group. They make up about 44 percent of the survey area.

4. Sandall-Rozlee-Promo association

Somewhat excessively drained and well-drained, moderately sloping to very steep cobbly silt loams; on terraces and mountain foot slopes

This association is mostly on high terraces surrounding Hansel Valley and Blue Creek Valley, and along the Promontory Mountains. Generally, the soils formed in alluvium, colluvium, and residuum derived from sandstone, limestone, and quartzite. At lower elevations, however, the soils formed in mixed lake sediments. Slopes are 3 to 70 percent. The vegetation is mainly bluebunch wheatgrass, juniper, cheatgrass, big sagebrush, bitterbrush, and annual grasses and weeds. Elevations are 4,350 to 6,800 feet. The average annual precipitation is 11 to 15 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 100 to 130 days.

This association makes up about 8 percent of the survey area. It is about 70 percent Sandall soils, 15 percent Rozlee soils, and 10 percent Promo soils. The Middle and Broad soils make up the remaining 5 percent of the association.

The Sandall soils are somewhat excessively drained. The surface layer is pale-brown cobbly silt loam, the subsoil is very pale brown gravelly heavy loam, and the substratum is light yellowish-brown and white very cobbly loam. Limestone bedrock is at a depth of 22 to 40 inches.

The Rozlee soils are well drained. The surface layer is grayish-brown cobbly silt loam, the subsoil is brown cobbly silt loam, and the substratum is very pale brown very cobbly silt loam. Fractured limestone bedrock is at a depth of 24 to 38 inches.

The Promo soils are somewhat excessively drained. They are pale-brown cobbly silt loam and cobbly loam throughout and are underlain, at a depth of 12 to 20 inches, by limestone bedrock.

The major soils in this association are used for range, wildlife habitat, and water supply. Upland game birds are common, and a few big-game animals inhabit the area.

5. *Hupp-Sterling-Abela association*

Well-drained and somewhat excessively drained, gently sloping to very steep gravelly silt loams and gravelly loams; on alluvial fans, lake terraces, escarpments, and mountain foot slopes

This association is on alluvial fans, lake terraces, and escarpments in several valleys in the survey area and along the Promontory Mountains. The soils formed in alluvium and colluvium derived from limestone, dolomite, sandstone, and quartzite and in mixed lake sediments. Slopes are 1 to 50 percent. The vegetation is big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, yellowbrush, cheatgrass, and annual weeds. Elevations are 4,300 to 5,400 feet. The average annual precipitation is 13 to 17 inches. The mean annual temperature is 45° to 49° F., and the frost-free season is 100 to 150 days.

This association makes up 7 percent of the survey area. It is 30 percent Hupp soils, 25 percent Sterling soils, and 25 percent Abela soils. The Bingham, Blue Star, Kapod, Pass Canyon, and Sheeprock soils are minor soils that make up the remaining 20 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Hupp soils are well drained. Slopes are 1 to 10 percent. The surface layer is grayish-brown and brown gravelly silt loam, and the subsoil and substratum are very gravelly silt loam.

The Sterling soils are somewhat excessively drained. Slopes are 1 to 50 percent. The surface layer is grayish-brown and brown gravelly loam, and the substratum is brown cobbly loam or very cobbly loam.

The Abela soils are well drained. Slopes are 6 to 20 percent. The surface layer is grayish-brown gravelly loam, the subsoil is pale-brown gravelly loam, and the substratum is pale-brown and very pale brown gravelly loam or very gravelly sandy loam.

The soils in this association are used chiefly for nonirrigated crops, range, wildlife habitat, and water supply. Some areas are used for urban development or as a source of gravel for construction purposes. These soils provide habitat for game birds.

6. *Kearns-Parleys association*

Well drained and moderately well drained, nearly level to steep silt loams; on alluvial fans and lake terraces

This soil association is mostly in Pocatello Valley, in the north end of Hansel Valley and the west side of Blue Creek Valley southward towards Golden Spike National Monument. The soils formed in alluvium derived from mixed lake sediments. Slopes are 0 to 20 percent. The vegetation is bluebunch wheatgrass, big sagebrush, cheatgrass, Sandberg bluegrass, western wheatgrass, yellowbrush, phlox, balsamroot, and annual weeds. Elevations are 4,220 to 5,575 feet. The average annual precipitation is 13 to 18 inches. The mean annual temperature is 45° to 51° F., and the frost-free season is 110 to 160 days.

This association makes up about 10 percent of the survey area. It is about 30 percent Kearns soils, 30 percent Parleys soils, and 20 percent Timpanogos, Fielding, and Kidman soils. The Red Rock, DeJarnet, Anty, Munk, Snowville, Gemson, Sterling, and Hupp soils make up the remaining 20 percent of the association.

The Kearns soils are well drained. The surface layer is grayish-brown silt loam, the subsoil is pale-brown silt loam, and the substratum is pale-brown and very pale brown silt loam or loam. These soils are more than 60 inches deep.

The Parleys soils are moderately well drained and well drained. The surface layer is grayish-brown silt loam, the subsoil is brown and pale-brown silty clay loam, and the substratum is pale-brown loam. These soils also are more than 60 inches deep. A water table is at a depth of 46 to more than 60 inches.

The major soils in this association are used for irrigated and nonirrigated crops and as wildlife habitat. Small areas are also used for urban development. These soils provide a good habitat for upland game birds.

7. *Sanpete-Stingal-Hansel association*

Somewhat excessively drained and well-drained, gently sloping to steep gravelly silt loams and silt loams; on lake terraces and escarpments

This association is in the lower part of Blue Creek Valley, in Hansel Valley, and near Snowville in Curlew Valley. The soils formed in mixed lake sediments and in alluvium and colluvium derived from limestone, sandstone, and quartzite. Slopes are 1 to 50 percent. The vegetation is big sagebrush, bluebunch wheatgrass, annual weeds and lesser amounts of other bunchgrasses and shrubs. Elevations are 4,300 to 5,300 feet. The average annual precipitation is 8 to 14 inches. The mean annual temperature is 46° to 51° F., and the frost-free season is 100 to 140 days.

This association makes up about 16 percent of the survey area. It is about 30 percent Sanpete soils, 20 percent Stingal soils, and 20 percent Hansel soils. Another 15 percent is Thiokol soils. The Eccles, Pomat, and Windmill soils make up the remaining 15 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Sanpete soils are somewhat excessively drained. Slopes are 1 to 50 percent. The surface layer is pale-brown gravelly silt loam, and the subsoil is pale-brown gravelly loam. The substratum is light-gray very gravelly heavy sandy loam or very pale brown very gravelly silt loam.

The Stingal soils are well drained. Slopes are 1 to 10 percent. The surface layer is light brownish-gray loam, the subsoil is very pale brown loam, and the substratum is pale-brown loam, white loam, and white very fine sandy loam.

The Hansel soils are well drained. Slopes are 1 to 10 percent. The surface layer is light brownish-gray silt loam, the subsoil is light-gray silty clay loam, and the substratum is light-gray silty clay loam.

The soils in this association are used for irrigated and nonirrigated crops, range, wildlife habitat, and industrial development. Upland game birds inhabit areas of this association.

8. Fielding-Kilburn-Kidman association

Well-drained and somewhat excessively drained, nearly level to very steep silt loams, gravelly sandy loams, and fine sandy loams; on lake terraces, benches, alluvial fans, and broad valley plains

This association is south of Garland and south of Brigham City. The soils formed in mixed lake sediments and alluvium derived from limestone, quartzite, sandstone, gneiss, and schist. Slopes are 0 to 60 percent. The vegetation is bluestem wheatgrass, big sagebrush, western wheatgrass, annual grasses, and other bunchgrasses and shrubs. Elevations are 4,250 to 5,150 feet. The average annual precipitation is 13 to 18 inches. The mean annual temperature is 46° to 51° F., and the frost-free season is 115 to 160 days.

This association makes up about 2 percent of the survey area. It is about 25 percent Fielding soils, 20 percent Kilburn soils, and 20 percent Kidman soils. The Parleys, Wasatch, Timpanogos, Millville, Francis, and Dagor soils and Stony alluvial land make up the remaining 35 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Fielding soils are well drained. Slopes are 0 to 3 percent. The surface layer is grayish-brown silt loam, the subsoil is pale-brown silt loam, and the substratum is light-gray loam, very pale brown silt loam, white silt loam, or pink silty clay loam.

The Kilburn soils are somewhat excessively drained. Slopes are 1 to 60 percent. The surface layer is dark grayish-brown gravelly sandy loam or brown sandy loam, the subsoil is brown gravelly loam, and the substratum is brown very gravelly sandy loam or brown very gravelly loamy sand.

The Kidman soils are well drained. Slopes are 1 to 20 percent. The surface layer and subsoil are brown fine sandy loam, and the substratum is light-gray, pinkish-gray, and very pale brown fine sandy loam. A water table is at a depth of 50 to 60 inches.

The soils in this association are used mainly for irrigated and nonirrigated crops, for range, and as wildlife habitat. Some areas are used for urban development or as a source of sand and gravel for construction purposes.

Moderately Well Drained and Well Drained Soils of the Medium and Low Lake Terraces and Lake Plains

These soils are on medium and low lake terraces and lake plains. They are silt loams that formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone.

Elevations of these soils are 4,225 to 5,125 feet. The average annual precipitation is 6 to 14 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 85 to 130 days. These soils are used for range, irrigated crops, nonirrigated crops, and wildlife habitat. In addition, small areas are used for industrial development.

Two associations of Box Elder County, Eastern Part, are in this group. They make up about 17 percent of the survey area.

9. Bram-Thiokol-Palisade association

Moderately well drained and well drained, nearly level to strongly sloping silt loams; on medium and low lake terraces and lake plains

This association is in Curlew Valley west of Snowville, southwest of Hansel Valley, and on Rozel Flats. The soils formed in calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 10 percent. The vegetation is big sagebrush, annual mustard, greasewood, cheatgrass, squirreltail, winterfat, Russian-thistle, and annual weeds. Elevations are 4,230 to 5,125 feet. The average annual precipitation is 8 to 14 inches, although in most areas it is 8 to 11 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 85 to 130 days.

This association makes up about 15 percent of the survey area. It is about 35 percent Bram soils, 30 percent Thiokol soils, and 15 percent Palisade soils. Another 10 percent is Saxby soils and Very stony land. The minor soils are the Mellor, Harding, Sanpete, and Etil soils and Gullied land, which together make up the remaining 10 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Bram soils are moderately well drained. The surface layer is light brownish-gray silt loam, the subsoil is very pale brown silt loam, and the substratum is very pale brown and light-gray silt loam.

The Thiokol soils are well drained. The surface layer and subsoil are light brownish-gray silt loam, and the substratum is white silt loam.

The Palisade soils are well drained. The surface layer is pale-brown silt loam, the subsoil is very pale brown silt loam, and the substratum is very pale brown silt loam, light-gray loam, or pale-brown very fine sandy loam.

The major soils in this association are used for range, nonirrigated and irrigated crops, wildlife habitat, and industrial development. Recreation is also an important use. Antelope and rabbits inhabit these soils and are hunted in season.

10. Drum-Uffens association

Moderately well drained and well drained, nearly level to moderately sloping silt loams; on low lake terraces and lake plains

This association is in the southwestern part of the survey area. The soils formed in calcareous lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 6 percent. The vegetation is greasewood, shadscale, pickleweed, kochia, rubber rabbitbush, annual mustard, cheatgrass, and annual weeds. Elevations are 4,225 to 4,450 feet. The average annual precipitation is 6 to 8 inches. The mean annual temperature is 48° to 51° F., and the frost-free season is 100 to 120 days.

This association makes up about 2 percent of the survey area. It is about 75 percent Drum soils and 20 percent Uffens soils. Small areas of Bram and Saltair soils and Playas make up the remaining 5 percent of the association.

The Drum soils are moderately well drained. The surface layer is light-gray silt loam, the subsoil is very pale brown silt loam, and the substratum is very pale brown and white silt loam or very pale brown and light-gray silty clay loam. These soils are more than 60 inches deep.

The Uffens soils are well drained. The surface layer is light brownish-gray silt loam, the subsoil is pale-brown and very pale brown silty clay loam, and the substratum is light-gray silt loam and white silty clay loam. These soils also are more than 60 inches deep.

The soils in this association are used for range and as wildlife habitat. Rabbits are hunted on these soils in winter and early in spring.

Moderately Well Drained to Poorly Drained Soils of the Low Lake Terraces and Lake Plains

These soils are on broad low lake terraces, broad lake plains, associated alluvial fans, and playas. They are silt loams and silty clay loams that formed in mixed lake sediments derived from many kinds of rocks.

Elevations of these soils are 4,205 to 4,600 feet. The average annual precipitation is 11 to 16 inches. The mean annual temperature is 46° to 51° F., and the frost-free season is 100 to 150 days. These soils are used for irrigated crops, native pasture, nonirrigated crops, range, and wildlife habitat.

Three associations of Box Elder County, Eastern Part, are in this group. They make up about 23 percent of the survey area.

11. Honeyville-Greenson-Collett association

Moderately well drained and somewhat poorly drained, nearly level silty clay loams and silt loams; on broad low lake terraces and lake plains

This association is southwest of Tremonton and extends southward from Brigham City to Willard Bay Reservoir. The soils formed in fine textured and moderately fine textured, mixed lake sediments derived dominantly from sandstone and limestone. Slopes are 0 to 1 percent. The vegetation is Great Basin wildrye, western wheatgrass, big sagebrush, and annual weeds on the Honeyville soils; saltgrass, alkali sacaton, greasewood, alkali bluegrass, and some foxtail and sedges on the Greenson soils; and Kentucky bluegrass, Great Basin wildrye, saltgrass, foxtail, and sedges on the Collett soils. Elevations are 4,250 to 4,355 feet. The average annual precipitation is 13 to 16 inches. The mean annual temperature is 47° to 51° F., and the frost-free season is 130 to 150 days.

This association makes up about 3 percent of the survey area. It is about 25 percent Honeyville soils, 15 percent Greenson soils, and 15 percent Collett soils. Another 25 percent is Roshe Springs, Logan, and Kirkham soils. The Cudahy, Draper, James Canyon, Magna, Martini, Peteetneet, Sunset, and Woods Cross soils make up the remaining 20 percent of the association.

The Honeyville soils are moderately well drained. The surface layer is silty clay loam, the subsoil is brown and pale-brown silty clay loam, and the substratum is pale-brown and pinkish-gray silty clay loam. A water table is at a depth of 30 to more than 60 inches.

The Greenson soils are somewhat poorly drained. The surface layer is grayish-brown silt loam, and the subsoil is pale-brown heavy silt loam. The substratum is stratified, very pale brown and light-gray silt loam and loam, pink silty clay, or light-gray fine sandy loam. A water table is at a depth of 30 to more than 60 inches.

The Collett soils are somewhat poorly drained. The surface layer is grayish-brown silty clay loam, the subsoil is light brownish-gray silty clay, and the substratum is white silty clay or light-gray and pink silty clay loam. A water table is at a depth of 30 to more than 60 inches.

The soils in this association are used for irrigated crops and native pasture.

12. Lasil-Fridlo association

Somewhat poorly drained and moderately well drained, nearly level and gently sloping silt loams; on broad low lake terraces and lake plains

This association is in the valley southwest of Bear River City and Corinne, in the central and southern parts of Blue Creek Valley, and along the eastern side of the Promontory Mountains. The soils formed in mixed lake sediments. The vegetation is saltgrass, greasewood, alkali sacaton, and annual weeds and grasses. Elevations are 4,220 to 4,600 feet. The average annual precipitation is 11 to 14 inches. The mean annual temperature is 46° to 50° F., and the frost-free season is 100 to 150 days.

This association makes up about 5 percent of the survey area. It is about 25 percent Lasil soils and about 15 percent Fridlo soils. The Airport, Stokes, and Placeritos soils each make up about 10 percent of this association, and the Arave and Payson soils each about 5 percent. The Gooch, Lakeshore, Lewiston, Woods Cross, Warm Springs, Syracuse, Greenson, and Refuge soils make up the remaining 20 percent of the association.

The Lasil soils are somewhat poorly drained. The surface layer is light brownish-gray and pale-brown silt loam, and the subsoil is pale-brown, light-gray, and very pale brown silty clay loam. The substratum is very pale brown and white silty clay loam. A water table is at a depth of 20 to 40 inches.

The Fridlo soils are moderately well drained. The surface layer is grayish-brown silt loam, and the subsoil is brown silt loam, pale-brown silty clay loam, or very pale brown silty loam. The substratum is light-gray and white silty clay loam. A water table is at a depth of 30 to more than 60 inches.

The soils in this association are used for irrigated and nonirrigated crops and for range.

13. Playas-Saltair association

Playas and poorly drained, nearly level silty clay loams; on lake beds and broad plains

This association surrounds the Great Salt Lake. The soils formed in strongly calcareous, mixed lake sediments. Slopes are less than 1 percent. These areas are nearly bare; the only vegetation is scattered areas of pickleweed and samphire. Elevations are 4,205 to 4,225 feet. The average annual precipitation is 12 to 15 inches. The mean annual temperature is 47° to 50° F., and the frost-free season is 110 to 150 days.

This association makes up about 15 percent of the survey area. It is about 65 percent Playas and 20 percent Saltair soils. The Logan, Pogal, and Refuge soils and Fresh water marsh make up the remaining 15 percent of the association.

Playas consist of stratified layers of silty clay, silty clay loam, and silt loam. They have a water table within 20 inches of the surface, and they are filled with water after heavy rains.

The Saltair soils are poorly drained. The surface layer is gray silty clay loam, and the substratum is light-gray silty clay loam and silt loam.

This association is used mainly for recreation and as a wildlife habitat. On the Playas, solar ponds and dikes have been constructed to impound mineral-heavy water pumped from the lake.

Descriptions of the Soils

This section describes the soil series and mapping units in Box Elder County, Eastern Part. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gullied land, for example, does not belong to a soil series, but nevertheless is listed in alphabetical order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit or units and the range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The soils of Box Elder County, Eastern Part, were mapped at two intensities, high and low. In the high-intensity survey, where detailed information was needed, the mapping was done in considerable detail. In the low-intensity survey, which is mainly range, the need for detail was less and the mapping was more generalized.

The intensity of the mapping for the units described in the following pages is indicated by the soil symbol in parentheses after the name of each mapping unit. This symbol also identifies the mapping unit on the detailed soil map. If the second letter of a symbol is a small letter, the unit was mapped at high intensity. A symbol having the second letter a capital represents low-intensity mapping. The composition of units mapped at low intensity is more variable than that of units mapped at high intensity, but composition has been controlled well enough to allow interpretations for expected uses.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the "Soil Survey Manual" (*10*).[2]

[2] Italic numbers in parentheses refer to Literature Cited, p. 220.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Abela gravelly loam, 10 to 20 percent slopes	16, 500	1. 3
Abela stony loam, 6 to 20 percent slopes	3, 600	. 3
Agassiz-Picayune association, very steep	5, 350	. 4
Airport silt loam	3, 150	. 2
Airport silt loam, sandy substratum	1, 300	. 1
Airport silt loam, strongly alkali	1, 350	. 1
Anty fine sandy loam, 1 to 6 percent slopes	1, 200	. 1
Anty fine sandy loam, 6 to 10 percent slopes	1, 150	. 1
Arave silty clay loam	3, 350	. 3
Bickmore loam, 50 to 70 percent slopes	580	(1)
Bingham loam, 1 to 6 percent slopes	2, 750	. 2
Bingham gravelly loam, 1 to 6 percent slopes	1, 650	. 1
Bingham gravelly loam, 6 to 10 percent slopes	1, 400	. 1
Blue Star gravelly loam, 6 to 20 percent slopes	2, 300	. 2
Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes	860	. 1
Blue Star association, steep	900	. 1
Borrow pits	495	(1)
Bram silt loam	58, 000	4. 6
Broad cobbly loam, 20 to 30 percent slopes	265	(1)
Broad cobbly loam, 30 to 60 percent slopes	6, 400	. 5
Broad-Manila association, steep	8, 200	. 7
Broad-Middle association, steep	10, 850	. 9
Broad-Smarts association, steep	17, 370	1. 4
Collett silty clay loam	5, 200	. 4
Collinston-Wheelon silt loams, 6 to 10 percent slopes	1, 500	0. 1
Cudahy silt loam	865	. 1
Dagor loam, 3 to 6 percent slopes	425	(1)
DeJarnet gravelly silt loam, 1 to 6 percent slopes	2, 710	. 2
DeJarnet gravelly silt loam, 6 to 10 percent slopes	2, 300	. 2
Draper loam, 0 to 3 percent slopes	255	(1)
Drum silt loam	13, 250	1. 1
Eccles fine sandy loam, 0 to 1 percent slopes	205	(1)
Eccles fine sandy loam, 1 to 6 percent slopes	3, 500	. 3
Eccles fine sandy loam, 6 to 10 percent slopes	1, 000	. 1
Eccles loamy sand, sandy variant, 1 to 6 percent slopes	510	(1)
Elzinga-Agassiz association, steep	900	. 1
Elzinga-Maughan complex, 25 to 50 percent slopes	800	. 1
Etil loamy sand, 1 to 6 percent slopes	2, 600	. 2
Fielding silt loam	9, 700	. 8
Fielding silt loam, warm	8, 250	. 7
Forsgren silt loam, 1 to 6 percent slopes	1, 400	. 1
Forsgren silt loam, 6 to 10 percent slopes	2, 060	. 2
Forsgren silt loam, 10 to 20 percent slopes	3, 065	. 2
Foxol-Elzinga association, steep	11, 820	. 9

See footnotes at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent
Foxol-Rock outcrop complex, 50 to 70 percent slopes	1,440	0.1
Fresh water marsh	6,770	.5
Francis loamy fine sand, 3 to 6 percent slopes	470	(1)
Fridlo silt loam	4,440	.3
Fridlo silt loam, moderately alkali	6,500	.5
Gemson silty clay loam, 6 to 10 percent slopes	900	.1
Gemson silty clay loam, 10 to 20 percent slopes	760	.1
Gemson-Rock land association, moderately steep	560	(1)
Gooch silt loam	1,645	.1
Goring-Yeates Hollow association, moderately steep	2,165	.2
Goring loam, brown subsoil variant	550	(1)
Gravel pits	1,000	.1
Greenson silt loam, clay substratum	5,210	.4
Greenson silt loam, strongly alkali	545	(1)
Gullied land	2,275	.2
Hansel silt loam, 0 to 1 percent slopes	6,800	.5
Hansel silt loam, 1 to 6 percent slopes	25,100	2.0
Hansel silt loam, 6 to 10 percent slopes	3,250	.2
Harding silt loam	5,500	.4
Hendricks silt loam, 1 to 6 percent slopes	730	.1
Hendricks silt loam, 6 to 10 percent slopes	955	.1
Hendricks silt loam, 10 to 20 percent slopes	1,200	.1
Hendricks complex, 6 to 10 percent slopes	3,900	.3
Honeyville silty clay loam	9,700	.8
Hupp gravelly silt loam, 1 to 6 percent slopes	7,800	.6
Hupp gravelly silt loam, 6 to 10 percent slopes	16,400	1.3
Hupp silt loam, 3 to 6 percent slopes	1,115	.1
Hupp silt loam, 6 to 10 percent slopes	1,225	.1
James Canyon loam, 0 to 3 percent slopes	1,550	.1
Kapod stony loam, 6 to 20 percent slopes	3,675	.3
Kearns silt loam, 1 to 3 percent slopes	13,300	1.0
Kearns silt loam, 3 to 6 percent slopes	16,350	1.3
Kearns silt loam, 6 to 10 percent slopes	6,250	.5
Kearns silt loam, 10 to 20 percent slopes	475	(1)
Kearns-Stingal complex, 6 to 10 percent slopes	2,140	.2
Kearns silt loam, high lime variant, 10 to 20 percent slopes	1,350	.1
Kidman fine sandy loam, 0 to 2 percent slopes	6,125	.5
Kidman fine sandy loam, 2 to 4 percent slopes	435	(1)
Kidman loam, 0 to 1 percent slopes	300	(1)
Kidman loam, 1 to 6 percent slopes	2,500	.2
Kidman loam, 6 to 10 percent slopes	560	(1)
Kidman loam, 10 to 20 percent slopes	640	.1
Kilburn gravelly loam, 1 to 3 percent slopes	3,000	.2
Kilburn gravelly sandy loam, 3 to 6 percent slopes	1,525	.1
Kilburn gravelly sandy loam, 6 to 10 percent slopes	650	.1
Kilburn gravelly sandy loam, 10 to 20 percent slopes	520	(1)
Kilburn gravelly sandy loam, 20 to 30 percent slopes	460	(1)
Kilburn gravelly sandy loam, 30 to 60 percent slopes	1,225	.1
Kirkham silt loam	3,050	.2
Lakeshore fine sandy loam	1,600	.1
Lasil silt loam	1,780	.1
Lasil silt loam, moderately alkali	12,200	1.0
Lasil-Airport silt loams	1,110	.1
Lewiston fine sandy loam	1,950	.1
Logan silty clay loam	2,180	.2
Lucky Star-Elzinga association, steep	1,700	.1
Magna silty clay loam	865	.1
Manila loam, 6 to 10 percent slopes	720	.1
Manila loam, 10 to 25 percent slopes	2,550	.2
Manila loam, 25 to 60 percent slopes	785	.1
Manila-Smarts association, steep	2,100	.2
Martini fine sandy loam	1,900	.1
Mellor silt loam, 1 to 6 percent slopes	9,200	0.7
Mellor-Thiokol silt loams, 1 to 6 percent slopes	8,800	.7
Middle cobbly silt loam, 10 to 30 percent slopes	13,800	1.1
Middle cobbly silt loam, 30 to 70 percent slopes	36,500	2.9
Middle-Broad association, steep	45,450	3.6
Middle-Rock outcrop complex, 10 to 30 percent slopes	950	.1
Middle-Rock outcrop complex, 30 to 60 percent slopes	1,575	.1
Mendon silt loam, 1 to 6 percent slopes	920	.1
Mendon silt loam, 6 to 10 percent slopes	360	(1)
Millville silt loam, 0 to 2 percent slopes	460	(1)
Millville silt loam, 2 to 4 percent slopes	530	(1)
Millville silt loam, moderately deep water table, 2 to 4 percent slopes	325	(1)
Munk gravelly silt loam, 10 to 20 percent slopes	610	.1
Obray clay, 10 to 25 percent slopes	1,050	.1
Palisade silt loam, 1 to 6 percent slopes	26,750	2.1
Palisade silt loam, 6 to 10 percent slopes	1,025	.1
Parleys loam, 0 to 3 percent slopes	2,300	.2
Parleys loam, cool, 0 to 3 percent slopes	4,900	.4
Parleys silt loam, 0 to 1 percent slopes	790	.1
Parleys silt loam, 1 to 6 percent slopes	17,400	1.4
Parleys silt loam, 6 to 10 percent slopes	6,300	.5
Parleys silt loam, 10 to 20 percent slopes	1,600	.1
Parleys silty clay loam, 0 to 3 percent slopes	295	(1)
Parleys-Munk complex, 6 to 10 percent slopes	845	.1
Parleys-Munk complex, 10 to 20 percent slopes	3,900	.3
Parleys-Pomat silt loams, 6 to 10 percent slopes	4,300	.3
Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes	1,520	.1
Payson silt loam	2,000	.1
Peteetneet peat, moderately deep variant	605	.1
Placeritos silt loam	6,400	.5
Playas	125,063	9.9
Pogal silt loam, rolling	7,100	.6
Pomat silt loam, 6 to 10 percent slopes	3,500	.3
Pomat silt loam, 10 to 30 percent slopes	5,250	.4
Pomat silt loam, 30 to 40 percent slopes, eroded	1,800	.1
Pomat-Kearns silt loams, 10 to 30 percent slopes	1,450	.1
Pomat-Parleys silt loams, 10 to 30 percent slopes	2,880	.2
Red Rock silt loam, high rainfall, 0 to 3 percent slopes	1,415	.1
Red Rock silt loam, 0 to 1 percent slopes	1,450	.1
Red Rock silt loam, 1 to 6 percent slopes	2,500	.2
Refuge loam	270	(1)
Richmond-Middle complex, 30 to 70 percent slopes, eroded	4,100	.3
Ridd-Rock outcrop complex, 10 to 30 percent slopes	375	(1)
Ridd-Rock outcrop complex, 30 to 70 percent slopes	610	.1
Rock land	6,900	.5
Rock outcrop	1,750	.1
Roshe Springs silt loam	4,400	.3
Rough broken land	4,100	.3
Rozlee-Rock outcrop complex, 30 to 70 percent slopes	4,500	.3
Saltair silty clay loam	39,100	3.1
Saltair-Fresh water marsh association	12,250	1.0
Saltair-Logan association	16,400	1.3
Saltair-Refuge complex	3,100	.2
Sandall cobbly silt loam, 10 to 30 percent slopes	5,600	.4

See footnotes at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Sandall cobbly silt loam, 30 to 60 percent slopes	12, 400	1. 0	Thiokol silt loam, 6 to 10 percent slopes	3, 910	0. 3
Sandall-Broad association, steep	7, 600	. 6	Thiokol silt loam, low rainfall, 0 to 1 percent slopes	31, 400	2. 5
Sandall-Promo association, steep	27, 540	2. 2	Thiokol silt loam, low rainfall, 1 to 3 percent slopes	10, 400	. 8
Sandall-Rock outcrop complex, 3 to 30 percent slopes	10, 600	. 9	Timpanogos loam, 0 to 3 percent slopes	1, 700	. 1
Sandall-Rozlee association, steep	30, 450	2. 4	Timpanogos loam, 3 to 6 percent slopes	400	(1)
Sanpete gravelly silt loam, 6 to 30 percent slopes	2, 780	. 2	Timpanogos loam, cool, 0 to 3 percent slopes	590	. 1
Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes	11, 000	. 9	Timpanogos silt loam, 1 to 6 percent slopes	8, 200	. 7
Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes	15, 030	1. 2	Timpanogos silt loam, 6 to 10 percent slopes	1, 400	. 1
Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes	18, 500	1. 5	Uffens silt loam	3, 605	. 3
Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes	3, 115	. 2	Very stony land	2, 320	. 2
Saxby-Thiokol complex, 1 to 6 percent slopes	15, 100	1. 2	Warm Springs fine sandy loam	1, 210	. 1
Saxby-Very stony land association	14, 200	1. 1	Wasatch gravelly sandy loam, 3 to 10 percent slopes	560	(1)
Sheeprock gravelly sandy loam, 6 to 10 percent slopes	705	. 1	Wasatch gravelly sandy loam, 10 to 25 percent slopes	610	. 1
Sheeprock gravelly loam, 10 to 40 percent slopes, severely eroded	2, 850	. 2	Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes	580	. 1
Smarts loam, 30 to 70 percent slopes	315	(1)	Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes	595	. 1
Snowville gravelly silt loam, 6 to 20 percent slopes	3, 000	. 2	Wheelon silt loam, 30 to 60 percent slopes	725	. 1
Sterling gravelly loam, 1 to 6 percent slopes	765	. 1	Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes	1, 940	. 1
Sterling gravelly loam, 6 to 20 percent slopes	9, 810	. 8	Wheelon-Collinston silt loams, 10 to 30 percent slopes	3, 240	. 2
Sterling gravelly loam, 20 to 30 percent slopes	3, 375	. 3	Windmill gravelly loam, 1 to 6 percent slopes	4, 950	. 4
Sterling gravelly loam, 30 to 50 percent slopes	2, 245	. 2	Windmill gravelly loam, 6 to 10 percent slopes	3, 920	. 3
Sterling very stony loam, 10 to 30 percent slopes	2, 080	. 2	Windmill gravelly loam, 10 to 20 percent slopes	2, 150	. 2
Sterling-Parleys complex, 6 to 20 percent slopes	3, 690	. 3	Woods Cross silty clay loam	1, 220	. 1
Stingal loam, 1 to 6 percent slopes	30, 570	2. 4	Woods Cross silty clay loam, moderately saline	1, 880	. 1
Stingal loam, 6 to 10 percent slopes	3, 960	. 3	Yeates Hollow cobbly clay loam, 20 to 30 percent slopes	1, 100	. 1
Stokes silt loam	6, 350	. 5	Yeates Hollow cobbly clay loam, 30 to 60 percent slopes	4, 720	. 4
Stony alluvial land	2, 450	. 2	Yeates Hollow-Goring association, steep	1, 960	. 1
Sunset silt loam	1, 100	. 1			
Syracuse fine sandy loam	1, 300	. 1	Total	1, 259, 278	100. 0
Thiokol silt loam, 0 to 1 percent slopes	9, 080	. 7			
Thiokol silt loam, 1 to 6 percent slopes	17, 000	1. 3			

1 Less than 0.05 percent.

Abela Series

The Abela series consists of well-drained soils. These soils are on alluvial fans and lake terraces. They formed in very gravelly and cobbly alluvium derived mostly from limestone but partly from sandstone and quartzite. Slopes range from 6 to 20 percent. Vegetation consists of big sagebrush, yellowbrush, bluebunch wheatgrass, cheatgrass, annual weeds, and in some places, juniper. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,400 to 5,300 feet.

In a representative profile, the surface layer is grayish-brown gravelly loam about 14 inches thick. The subsoil is pale-brown gravelly heavy loam about 14 inches thick. The substratum is pale-brown very gravelly loam in the upper part and very pale brown very gravelly loam and very gravelly sandy loam in the lower part. It extends to a depth of about 60 inches. The surface layer is moderately alkaline and moderately calcareous, the subsoil is strongly alkaline and strongly calcareous, and the substratum is very strongly alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 4 to 5 inches to a depth of 5 feet. The water-supplying capacity is about 7 to 8 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most roots are in the upper 30 inches of soil.

These soils are used mainly for range and wildlife habitat. A few small areas are used for nonirrigated crops.

Representative profile of Abela gravelly loam, 10 to 20 percent slopes, in range, 700 feet west and 600 feet south of the southeast corner of section 25, T. 10 N., R. 7 W., about 5 miles southwest of Golden Spike National Monument:

A11—0 to 5 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; 30 percent gravel; moderately calcareous; moderately alkaline (pH 8.3); abrupt, wavy boundary.

A12—5 to 14 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and

very fine roots; common very fine pores; 30 percent gravel; moderately calcareous; moderately alkaline (pH 8.3); clear, wavy boundary.

B2—14 to 28 inches, pale-brown (10YR 6/3) gravelly heavy loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common very fine pores; 30 percent gravel; strongly calcareous, thin lime coating on bottom side of pebbles; strongly alkaline (pH 8.6); clear, wavy boundary.

C1ca—28 to 39 inches, pale-brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; 55 percent gravel and 2 percent cobblestones; strongly calcareous, lime coating on pebbles; strongly alkaline (pH 9.0); abrupt, wavy boundary.

C2ca—39 to 49 inches, very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) when moist; massive; 80 percent gravel and 5 percent cobblestones; strongly calcareous, lime is strongly cemented; very strongly alkaline (pH 9.2); abrupt, wavy boundary.

C3—49 to 60 inches, very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) when moist; massive; loose; 60 percent gravel and 10 percent cobblestones; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Depth to very gravelly or very cobbly material ranges from 11 to 28 inches. Between depths of 10 and 40 inches, the material is gravelly, very gravelly, or cobbly loam that is 35 to 80 percent coarse fragments. The coarse fragments are mainly gravel-size and cobblestone-size angular limestone, sandstone, and quartzite that are mostly more than 1 inch in diameter. They have coatings of lime on all surfaces and, in places, are strongly cemented together. The soils are usually dry in all parts between depths of 8 and 24 inches.

In the A1 horizon, chroma is 2 or 3. Texture is gravelly loam, gravelly silt loam, or very gravelly loam that is 20 to 60 percent gravel. The A1 horizon is moderately alkaline to strongly alkaline and is slightly calcareous to moderately calcareous. In the B2 horizon, value is 3 or 4 when the soils are moist; chroma ranges from 2 to 4. The B2 horizon is moderately alkaline to strongly alkaline and moderately calcareous to strongly calcareous. In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; chroma is 2 or 3. Reaction is strongly alkaline to very strongly alkaline.

Abela gravelly loam, 10 to 20 percent slopes (ABE).— This soil is mainly in east- or west-facing areas and on alluvial fans and lake terraces. Slopes are medium to long. A profile of this soil is the one described as representative for the Abela series. Moderate sheet and rill erosion is common. Runoff is medium, and the hazard of erosion is moderate. Deep drainageways having steep side slopes dissect this soil in many places.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Middle cobbly silt loam, 10 to 30 percent slopes; Sanpete gravelly silt loam, 6 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used mainly for range and wildlife habitat. A few small areas are used for nonirrigated crops. Capability unit VIs–U, nonirrigated; Upland Stony Loam range site.

Abela stony loam, 6 to 20 percent slopes (AEE).— This soil is on alluvial fans. Slopes are medium to long and are slightly convex. The profile of this soil is similar to that described as representative for the Abela series, but this soil is covered with stones on about 5 percent of its surface. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Middle cobbly silt loam, 10 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Agassiz Series

The Agassiz series consists of somewhat excessively drained soils. These soils are on south- and west-facing mountains east of Mantua. They formed in residuum and colluvium derived from limestone. Slopes range from 30 to 70 percent. The vegetation consists of bluebunch wheatgrass, sagebrush, balsamroot, and buckwheat. Mean annual air temperature ranges from 44° to 47° F. Average annual precipitation ranges from 18 to 26 inches, and the frost-free period is 60 to 100 days. Elevations range from 5,200 to 7,500 feet.

In a representative profile, the surface layer is brown very stony loam and very cobbly loam about 14 inches thick. The underlying layer is yellowish-brown very cobbly loam about 5 inches thick. It overlies fractured limestone bedrock at a depth of about 19 inches. The profile is moderately alkaline throughout, and the substratum is strongly calcareous.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is 2 to 3 inches to bedrock. The water-supplying capacity is 6.5 to 9 inches before moisture is depleted. Roots penetrate to bedrock.

Agassiz soils are used for range, wildlife habitat, and water supply. Runoff carries a large amount of silt from these soils if they are not protected during periods of rapid rainfall.

Representative profile of Agassiz very stony loam, 30 to 70 percent slopes, in an area of Agassiz-Picayune association, very steep, in range, 1,000 feet west and 400 feet north of the southeast corner of section 23, T. 9 N., R. 1 W., east of Mantua:

A11—0 to 5 inches, brown (10YR 5/3) very stony loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine interstitial pores; 25 percent cobblestones, gravel, and stones; moderately alkaline (pH 8.0); clear, wavy boundary.

A12—5 to 14 inches, brown (10YR 5/3) very cobbly heavy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine interstitial pores; 50 percent cobblestones and gravel; moderately alkaline (pH 8.0); gradual, wavy boundary.

Cca—14 to 19 inches, yellowish-brown (10YR 5/4) very cobbly heavy loam, dark yellowish brown (10YR 4/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine interstitial pores; 75 percent cobblestones and gravel; strongly calcareous; moderately alkaline (pH 8.2); abrupt, irregular boundary.

R—19 inches, fractured limestone bedrock.

Depth to fractured limestone bedrock ranges from 14 to 19 inches. The soils are usually moist but are dry for 60 to 90 consecutive days in summer. The surface layer contains 20 to 50 percent cobblestones and 3 percent stones.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture in the A1

horizon is cobbly loam or very cobbly heavy loam. Reaction is mildly alkaline to moderately alkaline. In the Cca horizon, value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; chroma is 3 or 4. Texture in the Cca horizon is very cobbly heavy loam or very cobbly loam.

Agassiz-Picayune association, very steep (AGG).—This mapping unit is on the mountains east of the town of Mantua. It consists of about 60 percent Agassiz very stony loam, 30 to 70 percent slopes, and 25 percent Picayune gravelly loam, 40 to 70 percent slopes. Included with these soils in mapping are small areas of Elzinga silt loam, 25 to 50 percent slopes. This included soil makes up about 11 percent of the total acreage. Also included are small areas of Rock land, which makes up 3 percent, and Rock outcrop, which makes up 1 percent.

The Agassiz soil is on south- and west-facing, slightly concave to slightly convex mountain slopes under a cover of bunchgrass and sagebrush. The Picayune soil also is on south- and west-facing slopes under a cover of bunchgrass and sagebrush, but it is limited to concave positions. The Elzinga soil is in canyon bottoms and draws under maple trees. Rock land and Rock outcrop are on the knobs and tops of ridges.

Runoff is rapid on the soils of this association, and the hazard of erosion is high. Elevations range from 5,200 to 6,500 feet. The frost-free period is 70 to 100 days, and the average annual precipitation is 18 to 24 inches.

The soils of this association are used for range, wildlife habitat, and water supply. Agassiz very stony loam is in capability unit VIIs-M, nonirrigated; Mountain Shallow Loam range site. Picayune gravelly loam is in capability unit VIIe-M, nonirrigated; Mountain Loam range site.

Airport Series

The Airport series consists of somewhat poorly drained soils that are affected by alkali. These soils are on lake plains and low lake terraces in the valleys of the Bear River and the Malad River. They formed in mixed lake sediments. Slopes are less than 1 percent. The vegetation in noncultivated areas is saltgrass, alkali sacaton, and greasewood. Mean annual air temperature ranges from 47° to 52° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is from 110 to 115 days. Elevations range from 4,220 to 4,460 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 8 inches thick. The subsoil is brown and light brownish-gray silty clay loam about 10 inches thick. The substratum is light-gray and light-brown silty clay loam that extends to a depth of about 60 inches. The lower part of the subsoil and upper part of the substratum have accumulations of calcium carbonate. The surface layer is strongly alkaline and slightly calcareous. The subsoil and substratum are very strongly alkaline and slightly to strongly calcareous.

Permeability is slow, and the rate of water intake is slow. Roots penetrate to a depth of 60 inches.

Airport soils are used mainly for irrigated crops and range.

Representative profile of Airport silt loam, in a cultivated area, 225 feet west and 400 feet south of east quarter corner of section 34, T. 10 N., R. 3 W., 2½ miles west of the town of Corinne:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, subangular blocky structure; very hard, friable, slightly sticky and plastic; slightly calcareous; strongly alkaline (pH 8.1); abrupt, smooth boundary.

B21t—8 to 13 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure; extremely hard, firm, sticky and very plastic; few medium pores; continuous moderately thick clay films on ped faces; slightly calcareous; strongly alkaline (pH 8.9); clear, wavy boundary.

B22tca—13 to 18 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many fine and very fine pores; many thin clay films on ped faces; moderately calcareous; very strongly alkaline (pH 9.6); clear, wavy boundary.

C1ca—18 to 24 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 5/3) when moist; massive; very hard, firm, sticky and plastic; few fine roots; many very fine pores; strongly calcareous; very strongly alkaline (pH 9.6); gradual, wavy boundary.

C2—24 to 34 inches, very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) when moist; few, fine, distinct, brown (7.5YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few fine roots; many fine and very fine pores; moderately calcareous; very strongly alkaline (pH 9.6); gradual, wavy boundary.

C3—34 to 47 inches, light-brown (7.5YR 6/4) lake sediments consisting mainly of silty clay loam stratified with 1/16- to 2-inch layers of fine sandy loam, brown (7.5YR 4/4) when moist; few, fine, faint, brown (7.5YR 4/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine pores; slightly calcareous; strongly alkaline (pH 9.0); gradual, wavy boundary.

C4—47 to 60 inches, light-brown (7.5YR 6/4) heavy silty clay loam, brown (7.5YR 5/4) when moist; common, medium, faint, brown (7.5YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; many very fine pores; slightly calcareous; strongly alkaline (pH 9.0).

Depth to the horizon of carbonate accumulation ranges from 11 to 18 inches.

In the A1 horizon, value is 4 or 5 when the soils are dry and is 2 or 3 when they are moist; chroma is 1 or 2. Texture in the A1 horizon is dominantly silt loam but may be loam or light silty clay loam. Reaction is moderately alkaline to very strongly alkaline. The A1 horizon is slightly calcareous to strongly calcareous and ranges from 5 to 14 inches in thickness.

In the B2t horizon, hue is 10YR or 2.5Y; value ranges from 4 to 7 when the soils are dry and from 2 to 6 when they are moist; and chroma ranges from 1 to 3. Texture in the B2t horizon is dominantly silty clay loam but may be clay loam. Reaction is strongly alkaline to very strongly alkaline. The B2t horizon is slightly calcareous to strongly calcareous. The B2t horizon ranges from 5 to 16 inches in thickness.

In the Cca horizon, hue ranges from 7.5YR to 2.5Y; value is 7 or 8 when the soils are dry and ranges from 4 to 7 when they are moist; and chroma ranges from 1 to 3. Texture in the Cca horizon is dominantly silty clay loam but may be silty clay or clay loam. Reaction is moderately alkaline to very strongly alkaline. In the C horizon, hue ranges from 7.5YR to 5Y; value ranges from 5 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 1 to 4. Texture of the C horizon is clay loam, heavy silty clay loam, silty clay loam, silt loam, fine sandy loam, or sandy loam. Reaction is strongly alkaline to very strongly alkaline. The C horizon is slightly calcareous to strongly calcareous. The depth to the water table ranges from 26 to more than 60 inches.

Airport silt loam (Ao).—This soil is on lake plains and low lake terraces. Slopes are 0 to 1 percent. A profile of this soil is the one described as representative for the Airport series. The surface layer ranges from 8 to 14 inches in thickness and is moderately alkaline to strongly alkaline. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to

a depth of 5 feet. Elevations range from 4,225 to 4,300 feet, and the frost-free period is 130 to 150 days. This soil is slightly to moderately affected by salts and alkali.

Included with this soil in mapping are small areas of Lasil silt loam; Fridlo silt loam, moderately alkali; and Airport silt loam, sandy substratum.

This soil is used for irrigated crops and range. Irrigated crops are alfalfa, sugar beets, small grains, corn for silage, and pasture. Native vegetation is mostly saltgrass and greasewood. Improved range is mostly tall wheatgrass. Capability unit IVw–28, irrigated; Alkali Bottom range site.

Airport silt loam, sandy substratum (Ap).—This soil is on lake plains and low lake terraces. Slopes are 0 to 1 percent. The profile of this soil is similar to that described as representative for the Airport series, but the surface layer ranges from 5 to 9 inches in thickness and is moderately alkaline to strongly alkaline. The texture is mainly sandy loam between depths of 36 and 60 inches. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. Elevations range from 4,220 to 4,300 feet, and the frost-free period is 140 to 150 days. This soil is slightly to moderately affected by alkali and is slightly affected by salts.

Included with this soil in mapping are small areas of Airport silt loam, Payson silt loam, and Lasil silt loam.

This soil is used chiefly for irrigated alfalfa, small grains, sugar beets, corn for silage, sweet corn, and tomatoes. Capability unit IIIw–28, irrigated; Alkali Bottom range site.

Airport silt loam, strongly alkali (Ar).—This soil is on lake plains. Slopes are 0 to 1 percent. The profile of this soil is similar to that described as representative for the Airport series, but the surface layer ranges from 8 to 11 inches in thickness, is very strongly alkaline, and is silt loam or silty clay loam. Runoff is slow, and the hazard of erosion is slight. Because of the salt content, the water available to plants is only about 7 to 9 inches to a depth of 5 feet. If the soil is reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Elevations range from 4,300 to 4,460 feet, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of Lasil silt loam and Airport silt loam.

This soil is used mainly for range. Tall wheatgrass has been planted in some areas. Native vegetation consists of saltgrass, alkali sacaton, annual mustard, and greasewood. Capability unit VIIw–28, nonirrigated; Alkali Bottom range site.

Anty Series

The Anty series consists of well-drained soils. These soils are on intermediate and high lake terraces west and north of the town of Plymouth. They formed in strongly calcareous, mixed lake sediments and alluvium derived dominantly from limestone but partly from sandstone and quartzite. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of big sagebrush, yellowbrush, Indian ricegrass, bluebunch wheatgrass, cheatgrass, and annual weeds. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,400 to 5,000 feet.

In a representative profile, the surface layer is grayish-brown and dark grayish-brown fine sandy loam about 10 inches thick. The subsoil is pale-brown and light-gray fine sandy loam about 9 inches thick. The substratum is white fine sandy loam and sandy loam in the upper 16 inches and is loamy fine sand between depths of 35 and 62 inches. The surface layer is mildly alkaline and moderately calcareous, and the subsoil is mildly and moderately alkaline and moderately to strongly calcareous. The substratum is strongly alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 7.5 to 8.5 inches to a depth of 5 feet. The water-supplying capacity is 11 to 12 inches before the moisture is depleted. Roots penetrate easily to a depth of 48 inches but may extend to a depth of 60 inches or more.

These soils are used for nonirrigated crops.

Representative profile of Anty fine sandy loam, 1 to 6 percent slopes, in a cultivated field, 1,200 feet north and 700 feet west of the southwest corner of section 3, T. 13 N., R. 3 W., west of Plymouth:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft, friable, nonsticky and nonplastic; few very fine roots; common very fine pores; moderately calcareous; mildly alkaline (pH 7.6); clear, smooth boundary.

A1—5 to 10 inches, dark grayish-brown (10YR 4/2) light fine sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine pores; moderately calcareous; mildly alkaline (pH 7.8); clear, smooth boundary.

B21—10 to 15 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine roots; common very fine pores; moderately calcareous; moderately alkaline (pH 8.0); gradual, wavy boundary.

B22ca—15 to 19 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine pores; few krotovinas 10 to 15 millimeters in diameter, brown (10YR 4/3) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, irregular boundary.

C1ca—19 to 26 inches, white (10YR 8/2) fine sandy loam, light brownish gray (2.5Y 6/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine pores; few krotovinas ½ to ¾ inch in diameter, brown (10YR 4/3) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.0); gradual, irregular boundary.

C2ca—26 to 35 inches, white (10YR 8/2) sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine pores; few krotovinas ½ to ¾ inch in diameter, brown (10YR 4/3) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.

C3—35 to 62 inches, white (10YR 8/2) loamy fine sand, pale brown (10YR 6/3) when moist; few, medium, faint, dark yellowish-brown (10YR 4/4) mottles below a depth of 48 inches; massive; soft, friable; few very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9).

Depth to the horizon of carbonate accumulation ranges from 12 to 28 inches. Between depths of 10 and 40 inches, the texture

is commonly fine sandy loam and content of clay ranges from 14 to 18 percent. The soils are usually moist, but in most years they are dry in all parts at depths between 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. Texture is fine sandy loam or sandy loam. Reaction is mildly alkaline to moderately alkaline. The A1 horizon is slightly calcareous to moderately calcareous and ranges from 7 to 16 inches in thickness.

In the B2 horizon, value ranges from 5 to 7 when the soils are dry; chroma is 2 or 3. Texture is very fine sandy loam, fine sandy loam, or sandy loam. Reaction is mildly alkaline to strongly alkaline.

In the Cca and C horizons, hue is 10YR or 2.5Y; value is 7 or 8 when the soils are dry and 5 or 6 when they are moist; and chroma ranges from 2 to 4. Texture of the C horizon is fine sandy loam, sandy loam, loamy fine sand, or loamy sand.

Anty fine sandy loam, 1 to 6 percent slopes (AtB).—This soil is on south- and west-facing slopes on intermediate terraces. A profile of this soil is the one described as representative for the Anty series. Slopes are slightly convex and medium in length and most commonly are 1 to 3 percent. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Anty fine sandy loam, 6 to 10 percent slopes; Hansel silt loam, 1 to 6 percent slopes; and Kearns silt loam, 1 to 3 percent and 3 to 6 percent slopes.

This soil is used for nonirrigated crops. Wheat is the main crop grown. Capability unit IIIe-U, nonirrigated; range site not assigned.

Anty fine sandy loam, 6 to 10 percent slopes (AtD).—This soil is on south-facing slopes on intermediate and high lake terraces. Slopes are convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate. On the more prominent knolls and ridges, part of the original surface layer has been lost through erosion and the soil is moderately calcareous to strongly calcareous to the surface.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IIIe-U, nonirrigated; range site not assigned.

Arave Series

The Arave series consists of poorly drained soils that are affected by alkali. These soils are on low lake plains and low lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes range from 0 to 1 percent. The vegetation consists of saltgrass, alkali sacation, and some greasewood, foxtail, cheatgrass, sedges, and wiregrass. Mean annual air temperature ranges from 49° to 52° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,210 to 4,250 feet.

In a representative profile, the surface layer is light brownish-gray light silty clay loam about 4 inches thick, the subsoil is light brownish-gray silty clay loam about 7 inches thick, and the substratum is mostly white silty clay loam that extends to a depth of 60 inches. The surface layer and subsoil are very strongly alkaline and strongly calcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is slow. Because of the salt content, the water available to plants is only about 3 to 8 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of 60 inches but are commonly concentrated in the upper 24 inches.

These soils are used for range.

Representative profile of Arave silty clay loam, in range, about 2,100 feet east and 800 feet north of the southwest corner of section 32, T. 9 N., R. 6 W.:

A1—0 to 4 inches, light brownish-gray (10YR 6/2) light silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure; hard, firm, sticky and plastic; many very fine and fine roots; common very fine vesicular pores; strongly calcareous; very strongly alkaline (pH 9.2); clear, smooth boundary.

B2t—4 to 11 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; many very fine and fine roots; common very fine vesicular pores; many thin clay films on ped faces; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); clear, smooth boundary.

C1ca—11 to 15 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, smooth boundary.

C2ca—15 to 28 inches, white (10YR 8/1) heavy silty clay loam, light gray (2.5Y 7/1) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine and medium, blocky structure; hard, firm, very sticky and very plastic; few fine and very fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, wavy boundary.

C3ca—28 to 38 inches, white (10YR 8/1) silty clay loam, light gray (2.5Y 7/1) when moist; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few fine and very fine roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, wavy boundary.

C4—38 to 60 inches, white (10YR 8/2) light silty clay loam, light brownish gray (2.5Y 6/2) when moist; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few fine roots; strongly calcareous, lime disseminated; strongly alkaline (pH 9.0).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 10 to 19 inches. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer. Depth to the water table ranges from 12 to 30 inches. The effect of alkali and salts is moderate to strong. Distinct mottles are at a depth between 15 and 30 inches.

In the A1 horizon, value is 4 or 5 when the soils are moist; chroma is 1 or 2. Texture is light silty clay loam or silt loam. Reaction is strongly alkaline to very strongly alkaline. The A1 horizon is moderately calcareous to strongly calcareous and ranges from 4 to 8 inches in thickness.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 3 or 4 when they are moist; and chroma is 1 or 2. Texture is silty clay loam or light silty clay loam; content of clay ranges from 27 to 35 percent. Structure is weak to moderate, medium, prismatic. Reaction is moderately alkaline to very strongly alkaline, and the B2t horizon ranges from 6 to 11 inches in thickness.

In the Cca and C horizons, hue is 10YR, 2.5Y, and 5Y; value is 6 to 8 when the soils are dry and ranges from 5 to 7 when they are moist; and chroma is 1 or 2. Textures are silty clay loam, clay loam, silt loam, very fine sandy loam, and loam. Reaction is moderately alkaline to strongly alkaline.

Arave silty clay loam (AV).—This soil is on low lake plains and low lake terraces, mainly along the edge of salt playas of the Great Salt Lake. Slopes are 0 to 1 percent and generally are slightly concave. Runoff is slow to ponded, and the hazard of erosion is only slight.

Included with this soil in mapping are small areas of Etil loamy sand, 1 to 6 percent slopes, and Saltair silty clay loam.

This soil is used chiefly for range. A small area is irrigated and produces mainly tall wheatgrass. Capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Bickmore Series

The Bickmore series consists of well-drained soils. These soils are on north-facing mountains south of Mantua. They formed in residuum and colluvium devived from limestone. Slopes range from 50 to 70 percent. Vegetation consists mainly of Douglas-fir and alpine fir, and there is an understory of snowberry, Oregongrape, lupine, and horsemint. Mean annual air temperature ranges from 37° to 40° F. Average annual precipitation ranges from 24 to 28 inches, and the frost-free period is 45 to 60 days. Elevations range from 6,800 to 8,100 feet.

In a representative profile, the surface layer is dark-brown loam about 10 inches thick. The subsoil is yellowish-brown gravelly silty clay loam about 12 inches thick. The substratum is pale-brown very gravelly loam that is about 17 inches thick over limestone bedrock. The profile is neutral throughout.

Permeability is moderate to a depth of 22 inches but is moderately rapid below that depth. The rate of water intake is rapid. Available water holding capacity is 4 to 6 inches to bedrock. The water-supplying capacity ranges from 11 to 13 inches before moisture is depleted. Roots penetrate to bedrock.

Bickmore soils are used for woodland, wildlife habitat, and watershed.

Representative profile of Bickmore loam, 50 to 70 percent slopes, in woodland, 1,000 feet east and 400 feet north of the southwest corner of section 10, T. 8 N., R. 1 W., on Block Mountain south of Mantua:

O1—2 inches to 0, matted decaying needles and twigs from conifers.

A1—0 to 10 inches, dark-brown (10YR 3/3) loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable, slightly sticky and plastic; common fine and medium roots and few coarse roots; 15 percent gravel; neutral (pH 6.6); clear, wavy boundary.

B2t—10 to 22 inches, yellowish-brown (10YR 5/4) gravelly silty clay loam, dark brown (10YR 3/3) when moist; moderate, medium and fine, subangular blocky structure; hard, friable, slightly sticky and plastic; common fine and medium roots; many very fine pores; common thin clay films on ped faces; 40 percent gravel and cobblestones; neutral (pH 6.6); diffuse, wavy boundary.

Cca—22 to 39 inches, pale-brown (10YR 6/3) very gravelly loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; few fine roots; many very fine pores; 70 percent gravel and cobblestones; slightly calcareous in top of horizon to strongly calcareous at the bottom; neutral (pH 6.8); abrupt, wavy boundary.

R—39 inches, fractured limestone bedrock.

The solum ranges from 20 to 31 inches in thickness. Depth to bedrock ranges from 35 to 40 inches. Coarse fragments are gravel and cobblestones, and their content ranges from 10 to 25 percent in the A1 horizon, from 35 to 40 percent in the B2t horizon, and from 60 to 80 percent in the Cca horizon. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for about 50 to 60 consecutive days in summer.

In the A1 horizon, chroma is 2 or 3. Texture is loam or gravelly loam. The A1 horizon ranges from 10 to 16 inches in thickness. In the B2t horizon, chroma is 3 or 4. Texture in the B2t horizon is gravelly silty clay loam or cobbly silty clay loam. Clay films range from thin to moderately thick on ped faces. Thickness of the B2t horizon ranges from 10 to 15 inches. The horizon of carbonate accumulation may begin in the bottom of the B2t horizon but is most commonly in the Cca horizon. In the Cca horizon, chroma is 3 or 4. Texture of the Cca horizon is very gravelly loam or very cobbly loam. This horizon is slightly to strongly calcareous and is neutral to mildly alkaline.

Bickmore loam, 50 to 70 percent slopes (BCG).—This soil is on north-facing mountain slopes. Runoff is very rapid, and the hazard of erosion is very high.

Included with this soil in mapping are small areas of Agassiz very stony loam, 30 to 70 percent slopes, and a dark-colored soil that formed in material derived from quartzite and contains many coarse fragments.

This Bickmore soil is used for woodland, watershed, and wildlife habitat. Sawtimber is harvested from some areas. Use of equipment for timber harvesting is limited by steep slopes. Capability unit VIIe-HC, nonirrigated; range site not assigned.

Bingham Series

The Bingham series consists of well-drained soils. These soils are on intermediate and high lake terraces and alluvial fans. They formed in mixed lake sediments and very gravelly alluvium derived mainly from quartzite, sandstone, and limestone. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas is big sagebrush, bluebunch wheatgrass, Great Basin wildrye, and Sandberg bluegrass. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,500 to 5,200 feet.

In a representative profile, the surface layer is dark grayish-brown gravelly loam about 7 inches thick. The subsoil is dark grayish-brown and grayish-brown gravelly light clay loam about 14 inches thick. The substratum is light brownish-gray very gravelly light loam between depths of 21 to 31 inches and then is pale-brown very gravelly loamy sand that extends to a depth of 60 inches. The surface layer and subsoil are moderately alkaline and noncalcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is rapid, and the rate of water intake is rapid. Most roots are concentrated in the upper 30 inches of soil and only a few penetrate into the very gravelly loamy sand material.

These soils are used for nonirrigated crops.

Representative profile of Bingham gravelly loam, 6 to 10 percent slopes, in a cultivated field, 625 feet north and 550

feet west of the south quarter corner of section 10, T. 12 N., R. 3 W., about 1½ miles west of the town of Riverside:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 20 percent gravel; moderately alkaline (pH 8.0); clear, smooth boundary.

B21t—7 to 14 inches, dark grayish-brown (10YR 4/2) gravelly light clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; common thin clay films on ped faces; 25 percent gravel; moderately alkaline (pH 8.0); clear, smooth boundary.

B22t—14 to 21 inches, grayish-brown (10YR 5/2) gravelly light clay loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and slightly plastic; common fine and very fine roots; common fine and few medium pores; many thin clay films on ped faces; 40 percent gravel; moderately alkaline (pH 8.0); clear, smooth boundary.

C1ca—21 to 31 inches, light brownish-gray (10YR 6/2) very gravelly light loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 65 percent gravel and cobblestones; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

IIC2ca—31 to 60 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) when moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine and very fine roots; 75 percent gravel and cobblestones; strongly calcareous, lime is disseminated, weakly cemented in lower part; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 16 to 26 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. The A1 horizon is dominantly gravelly loam that contains 15 to 30 percent gravel, but in places it is loam that contains 5 to 15 percent gravel. Reaction is mildly alkaline to moderately alkaline.

In the B2t horizon, value ranges from 4 to 6 when the soils are dry and is 2 or 3 when they are moist; chroma is 2 or 3. The B2t horizon is gravelly light clay loam or gravelly heavy loam that contains 20 to 45 percent gravel. Clay films are few to many on ped faces. Reaction is mildly alkaline to moderately alkaline. Thickness of the B2t horizon ranges from 6 to 14 inches.

In the Cca horizon, value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; chroma is 2 or 3. The Cca horizon is very gravelly loam, very gravelly sandy loam, very gravelly loamy sand, or very gravelly sand that contains 50 to 80 percent gravel and cobblestones. This horizon is noncemented to weakly or strongly cemented, and the coarse fragments are well coated with lime.

Bingham loam, 1 to 6 percent slopes (BdB).—This soil is on alluvial fans and on intermediate to high lake terraces. Slopes are short to medium in length. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 4.5 to 5 inches to a depth of 5 feet. The water-supplying capacity is 8 to 9 inches before moisture is depleted.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; and Parleys silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IVs–U4, nonirrigated; range site not assigned.

Bingham gravelly loam, 1 to 6 percent slopes (BeB).—This soil is on intermediate to high lake terraces and alluvial fans. Slopes are medium to long and slightly convex. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity to a depth of 5 feet is 4 to 4.5 inches. The water-supplying capacity is 8 to 9 inches before moisture is depleted.

Included with this soil in mapping are small areas of Bingham loam, 1 to 6 percent slopes; DeJarnet gravelly silt loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; and Sterling gravelly loam, 1 to 6 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IVs–U4, nonirrigated; range site not assigned.

Bingham gravelly loam, 6 to 10 percent slopes (BeD).—This soil is on intermediate to high lake terraces and alluvial fans. Slopes are short to medium in length and slightly convex. A profile of this soil is the one described as representative for the Bingham series. Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity to a depth of 5 feet is 4 to 4.5 inches. The water-supplying capacity is 8 to 9 inches before moisture is depleted.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IVs–U4, nonirrigated; range site not assigned.

Blue Star Series

The Blue Star series consists of well-drained soils. These soils are on alluvial fans, lake terraces, and terrace escarpments on Fremont Island and in the southern part of the Promontory Mountain range. They formed in gravelly alluvium derived dominantly from quartzite, limestone, and argillite. Slopes range from 6 to 60 percent but most commonly are 6 to 20 percent. Vegetation consists mainly of big sagebrush, snakeweed, Sandberg bluegrass, three-awn, cheatgrass, and some juniper. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,250 to 4,950 feet.

In a representative profile, the surface layer is brown gravelly loam about 10 inches thick. The subsoil is pale-brown gravelly heavy sandy loam about 12 inches thick. The substratum is pale-brown gravelly coarse sandy loam between depths of 22 and 37 inches and then is very pale brown gravelly coarse sand that extends to a depth of 60 inches. The surface layer is moderately alkaline and slightly calcareous, and the subsoil is strongly alkaline and slightly calcareous. A layer of strong lime accumulation is at a depth of 22 inches.

Permeability is moderately rapid above a depth of 37 inches but is rapid below that depth. The rate of water intake is rapid. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is about 7 to 9 inches before moisture is depleted. Only a few roots penetrate to a depth below 37 inches.

These soils are used for range.

Representative profile of Blue Star gravelly loam, 6 to 20 percent slopes, in range, 2,100 feet north and 300 feet east of the southwest corner of section 19, T. 6 N., R. 5 W.:

A1—0 to 10 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; soft, friable, nonsticky and slightly plastic; many fine and medium roots and few coarse roots; 20 percent fine gravel; slightly calcareous, moderately alkaline (pH 8.4); clear, irregular boundary.

B2—10 to 22 inches, pale-brown (10YR 6/3) gravelly heavy sandy loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few fine, medium, and coarse roots; common very fine tubular pores; 35 percent fine gravel; slightly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

C1ca—22 to 37 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; common fine tubular pores; 30 percent fine gravel, coated with lime; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); abrupt, irregular boundary.

C2—37 to 60 inches, very pale brown (10YR 8/3) gravelly coarse sand, pale brown (10YR 6/3) when moist; single grained; loose; 50 percent fine gravel; strongly calcareous, under side of gravel coated with lime; strongly alkaline (pH 8.5).

Between depths of 10 to 40 inches, the texture averages gravelly sandy loam and the content of coarse fragments ranges from 25 to 35 percent. The coarse fragments are mainly fine gravel-size quartzite, limestone, and argillite and range from ⅛ to ½ inch in diameter. The soils are usually dry in all parts between depths of 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is gravelly loam or light loam. The A1 horizon is generally noncalcareous but in places is slightly calcareous. It ranges from 7 to 12 inches in thickness.

In the B2 horizon, value is 5 or 6 when the soils are dry; chroma is 2 or 3. The B2 horizon is moderately alkaline to strongly alkaline.

In the Cca and C2 horizons, hue is 7.5YR or 10YR; value ranges from 6 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma is 2 or 3. The C horizons are gravelly loam, gravelly sandy loam, gravelly loamy sand, or gravelly coarse sand. They are 20 to 50 percent fine gravel. Reaction is moderately alkaline to strongly alkaline. In some places the Cca horizon is weakly cemented.

Blue Star gravelly loam, 6 to 20 percent slopes (BgE).—This soil is on alluvial fans, mainly in the southern part of the Promontory Mountain range. A profile of this soil is the one described as representative for the Blue Star series. Runoff is medium, and the hazard of erosion is moderate. A few shallow to deep gullies have been formed.

Included with this soil in mapping are small areas of Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes, and Sheeprock gravelly sandy loam, 6 to 10 percent slopes.

This soil is used mainly for range. A small area is used for nonirrigated small grains. Capability unit VIs-U, nonirrigated; Upland Stony Loam range site.

Blue Star association, steep (BLG).—This mapping unit is on Fremont Island. It consists of about 60 percent Blue Star gravelly loam, 30 to 60 percent slopes; 38 percent Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes; and 2 percent Rock outcrop.

These soils are intermingled. The Blue Star soil is on east- and north-facing side slopes on fans and lake-terrace escarpments under a cover of cheatgrass and bunchgrass. Slopes are medium in length, are slightly convex, and most commonly are 30 to 40 percent. The Blue Star gravelly subsoil variant is on east- and north-facing side slopes on lake terraces and terrace escarpments under a cover of cheatgrass and bunchgrass. Slopes are short and convex. Rock outcrop is at the tops of ridges.

Runoff is rapid on the Blue Star soil, and the hazard of erosion is high. Runoff is medium on the Blue Star gravelly subsoil variant, and the hazard of erosion is moderate.

The soils of this association are used for range. Blue Star gravelly loam is in capability unit VIIs-U, nonirrigated; Upland Stony Loam range site. Blue Star gravelly subsoil variant is in capability unit VIs-U, nonirrigated; Upland Sand range site.

Blue Star Series, Gravelly Subsoil Variant

The Blue Star series, gravelly subsoil variant, consists of somewhat excessively drained soils. These soils are on alluvial fans, narrow lake terraces, and terrace escarpments on Fremont Island. They formed in gravelly alluvium derived mainly from argillite and tillite but partly from limestone and quartzite. Slopes range from 6 to 10 percent. The vegetation is mainly cheatgrass, Sandberg bluegrass, snakeweed, and annuals. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,250 to 4,950 feet.

In a representative profile, the surface layer is brown gravelly loam about 7 inches thick. The subsoil is brown gravelly loam about 12 inches thick. The substratum, extending to a depth of 60 inches, is grayish-brown very gravelly loamy coarse sand and very gravelly loamy fine sand. The surface layer and subsoil are mildly alkaline. The substratum is strongly alkaline and moderately to strongly calcareous. A layer of strong lime accumulation is at a depth of 19 inches.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 3.5 to 5.5 inches to a depth of 5 feet. The water-supplying capacity is 5 to 7 inches before moisture is depleted. Only a few roots penetrate to a depth below 24 inches.

Blue Star gravelly subsoil variant soils are used for range.

Representative profile of Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes, in range, 500 feet north and 600 feet east of the west quarter corner of section 17, T. 14 N., R. 4 W., on the east side of Fremont Island:

O1—1 inch to 0, mulch, partially decomposed vegetation mixed with soil, area has been burned several times over the years; very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2) when moist.

A1—0 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; 20 percent fine angular gravel, mainly from tillite and argillite; mildly alkaline (pH 7.6); clear, smooth boundary.

B2—7 to 19 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; 20 percent fine angular gravel, mainly from tillite and argillite; mildly alkaline (pH 7.8); gradual, wavy boundary.

C1ca—19 to 46 inches, grayish-brown (10YR 5/2) very gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose; 50 percent fine angular gravel, mainly from tillite and argillite; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5); gradual, wavy boundary.

C2—46 to 60 inches, grayish-brown (10YR 5/2) very gravelly loamy fine sand, dark brown (10YR 3/3) when moist; single grained; loose; 60 percent fine angular gravel, mainly from tillite and argillite; moderately calcareous, lime is disseminated; strongly alkaline (pH 9.0).

In the foregoing profile, the dark color of the soil below a depth of 19 inches is from dark-colored minerals found in the tillite and argillite rocks.

Coarse fragments are mainly fine gravel (chiplike) from argillite, tillite, and limestone and are about ⅛ to ½ inch in diameter. Between depths of 10 to 40 inches, the texture averages gravelly loamy sand and the content of coarse fragments ranges from 20 to 50 percent. The soils are usually dry in all parts between depths of 8 to 24 inches.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture of this horizon is gravelly loam or gravelly light loam, and its content of coarse fragments is 10 to 30 percent. Reaction is mildly alkaline to moderately alkaline. The A1 horizon ranges from 7 to 12 inches in thickness.

In the B2 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Reaction is mildly alkaline to moderately alkaline. The B2 horizon is noncalcareous to slightly calcareous.

In the Cca and C horizon, hue is 7.5 or 10YR; value is 5 or 6 when the soils are dry and ranges from 2 to 6 when they are moist; and chroma is 2 or 3. In the Cca and C horizon, the dark color of the soil is from dark minerals found in the tillite and argillite rocks. These horizons are gravelly or very gravelly loamy fine sand or gravelly or very gravelly loamy coarse sand that contains 40 to 70 percent gravel. Reaction in the Cca and C horizon is moderately alkaline to strongly alkaline. The horizons are moderately calcareous to strongly calcareous.

Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes (BhD).—This soil is on alluvial fans and terrace escarpments on Fremont Island. Slopes are medium in length. Runoff is medium, and the hazard of erosion is moderate. A few shallow gullies have been formed.

Included with this soil in mapping are small areas of Blue Star gravelly loam, 6 to 20 percent slopes, and Sheeprock gravelly sandy loam, 6 to 10 percent slopes.

This soil is used for range. Capability unit VIs-U, nonirrigated; Upland Sand range site.

Borrow Pits

Borrow pits (Bp) is a miscellaneous land type that occurs at many locations in the survey area. The pits are open excavations from which soil and underlying materials have been removed. The soil material from these areas has been used for the construction of dams, dikes, levees, and highways. The material remaining in the pits is cobbly, stony, or gravelly, and its texture ranges from clay loam to sand. The side slopes of these borrow pits are very steep and generally have been left in roughened condition. In the bottom of most pits, the surface is very rough and uneven, and this condition prohibits the use of common tillage implements. A shallow water table is present in the bottom of a few pits.

These areas are nearly barren but support a thin stand of Russian thistle, sunflower, gumweed, sweetclover, and a few willows.

Borrow pits generally are not suited to use as range but may have some value for wildlife habitat or industrial uses. Capability unit VIIIs-4; nonirrigated; range site not assigned.

Bram Series

The Bram series consists of moderately well drained and well drained soils. These soils are on lake plains and lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes range from 0 to 1 percent. The vegetation consists of shadscale, greasewood, annual mustard, squirreltail, cheatgrass, and winterfat. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,230 to 4,500 feet.

In a representative profile, the surface layer is light brownish-gray silt loam about 5 inches thick, the subsoil is very pale brown silt loam about 7 inches thick, and substratum is very pale brown and light-gray silt loam that extends to a depth of 64 inches. This soil is moderately calcareous and strongly alkaline to a depth of about 12 inches and strongly calcareous and strongly alkaline between depths of 12 and 64 inches.

Permeability is moderately slow, and the rate of water intake is moderate. The water-holding capacity is 9 to 12 inches to a depth of 5 feet, but the water available to plants is only about 4 to 7 inches because of the high salt content. The water-supplying capacity is 5.5 to 8 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most are in the upper 30 inches of the soil.

These soils are used mainly for range. Some areas are used for irrigated crops and wildlife habitat.

Representative profile of Bram silt loam, in range, 700 feet east and 100 feet north of the east quarter corner of section 23, T. 9 N., R. 8 W., about 9 miles southwest of Golden Spike National Monument:

A11—0 to 2 inches, light brownish-gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/3) when moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and fine vesicular pores; moderately calcareous; very strongly alkaline (pH 8.9); abrupt, smooth boundary.

A12—2 to 5 inches, light brownish-gray (10YR 6/2) silt loam, brown (10YR 4/3) when moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.8); clear, smooth boundary.

B2—5 to 12 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) when moist; weak, thick, platy structure that parts to weak, fine and medium, subangular blocky; hard, friable, sticky and plastic; common fine and few medium roots; many very fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.

C1ca—12 to 18 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; weak, medium, subangular blocky structure; very hard, friable, sticky and plastic; few fine and medium roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); gradual, smooth boundary.

C2ca—18 to 23 inches, very pale brown (10YR 7/3) heavy silt loam, brown (10YR 5/3) when moist; massive; very hard, friable, sticky and plastic; few fine and medium roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); gradual, smooth boundary.

C3—23 to 36 inches, light-gray (2.5Y 7/2) heavy silt loam, light olive brown (2.5Y 5/3) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, smooth boundary.

C4—36 to 64 inches, light-gray (2.5Y 7/2) heavy silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine and medium interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0).

Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 15 to 18 percent. The soils are usually dry in all parts between depths of 4 to 12 inches. In some areas, faint to distinct mottles are at depths below 30 to 50 inches. These soils are moderately to strongly affected by salts and alkali. Depth to the water table in irrigated areas ranges 26 to 40 inches

In the A1 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma is 2 or 3. Texture in the A1 horizon is dominantly silt loam but may be loam or very fine sandy loam. Reaction is moderately alkaline to very strongly alkaline. The A1 horizon ranges from 4 to 10 inches in thickness.

In the B2 horizon, hue is dominantly 10YR but ranges from 7.5YR to 2.5Y; value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam or very fine sandy loam. Reaction in the B2 horizon is strongly alkaline to very strongly alkaline. Thickness of the B2 horizon ranges from 4 to 10 inches.

In the Cca and C horizons, hue is 10YR, 2.5Y, 5Y, or 7.5YR; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam or very fine sandy loam. Reaction is strongly alkaline to very strongly alkaline. In the Cca horizons, the calcium carbonate equivalent ranges from 20 to 35 percent.

Bram silt loam (BR).—This soil is in broad lake plains and lake terraces. Slopes are generally 0 to 1 percent, but in small areas they range from 1 to 4 percent. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Palisade silt loam, 1 to 6 percent slopes; Harding silt loam; and Thiokol silt loam, low rainfall, 0 to 1 percent slopes.

This soil is used mainly for range. Very small areas are used for irrigated alfalfa, sugar beets, corn for silage, tomatoes, small grains, and irrigated pasture. Capability unit IIIw-28, irrigated; capability unit VIIs-S8, nonirrigated; Semidesert Alkali Flats range site.

Broad Series

The Broad series consists of well-drained soils. These soils are on north- and east-facing mountains surrounding the Howell-Blue Creek valley. They formed in residuum and colluvium derived from sandstone, limestone, and quartzite. Slopes range from 20 to 60 percent. The vegetation is dominantly bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, serviceberry, snowberry, and annual grass. Mean annual air temperature ranges from 42° to 44° F. Average annual precipitation ranges from 16 to 19 inches, and the frost-free period is 75 to 100 days. Elevations range from 5,300 to 7,000 feet.

In a representative profile, the surface layer is dark grayish-brown cobbly loam about 9 inches thick. The subsoil is brown gravelly and very gravelly clay loam about 19 inches thick. The substratum is very pale brown very gravelly loam that extends to sandstone bedrock at a depth of about 36 inches. The surface layer is neutral, the subsoil is mildly alkaline, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is about 4 to 5 inches to bedrock. The water-supplying capacity is about 6.5 to 8 inches before moisture is depleted. Roots extend to bedrock.

Broad soils are used for range, wildlife habitat, and water supply.

Representative profile of Broad cobbly loam, 30 to 60 percent slopes, in an area of the Broad-Middle association, steep, in range, 200 feet west and 400 feet south of the northeast corner of section 15, T. 13 N., R. 4 W., about 4 miles northeast of Whites Valley:

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; common very fine interstitial pores; 20 percent cobblestones and gravel; neutral (pH 7.2); clear, smooth boundary.

A12—3 to 9 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; common very fine interstitial pores; 20 percent cobblestones and gravel; neutral (pH 7.2); clear, smooth boundary.

B1—9 to 12 inches, brown (10YR 4/3) gravelly clay loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, subangular blocky structure; hard, firm, slightly sitcky and plastic; many fine and very fine roots; common very fine interstitial pores; 25 percent gravel and cobblestones; mildly alkaline (pH 7.4); clear, smooth boundary.

B21t—12 to 22 inches, brown (10YR 5/3) gravelly clay loam, brown (7.5YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; common very fine interstitial pores; many thin clay films on ped faces and in pores; 25 percent gravel and cobblestones; mildly alkaline (pH 7.8); gradual, wavy boundary.

B22t—22 to 28 inches, brown (7.5YR 5/4) very gravelly clay loam, brown (7.5YR 4/4) when moist: moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; few very fine interstitial pores; many thin clay films on ped faces and in pores; 55 percent gravel and cobblestones; mildly alkaline (pH 7.8); gradual, wavy boundary.

Cca—28 to 36 inches, very pale brown (10YR 8/3) very gravelly heavy loam, light yellowish brown (10YR 6/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; very fine interstitial pores: 65 percent gravel and cobblestones; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.0); abrupt, smooth boundary.

R—36 inches, fractured sandstone bedrock.

Depth to the horizon of carbonate accumulation ranges from 23 to 36 inches. Depth to bedrock ranges from 30 to 40 inches. Coarse fragments are mostly cobblestones and gravel; their content ranges from 10 to 20 percent in the surface layer, 25 to 50 percent in the subsoil, and 50 to 80 percent in the substratum. From 25 to 35 percent of the surface is covered with gravel, cobblestones, and a few stones. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is generally cobbly loam or gravelly loam but is loam or silt loam in some places. It is neutral to mildly alkaline and ranges from 7 to 15 inches in thickness.

In the B2t horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; and chroma ranges from 2 to 4. This horizon is gravelly or very gravelly clay loam to cobbly or very cobbly clay loam. Reaction is mildly alkaline to moderately alkaline. The B2t horizon ranges from 7 to 19 inches in thickness. The horizon of

carbonate accumulation begins in the lower part of the B2t horizon in some profiles but generally is in the Cca horizon.

In the Cca horizon, hue is 10YR or 7.5YR; value ranges from 5 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma ranges from 2 to 4. This horizon is very gravelly loam, very gravelly clay loam, cobbly loam, or cobbly clay loam. Reaction is moderately alkaline to strongly alkaline.

Broad cobbly loam, 20 to 30 percent slopes (BSE).—This soil is on north- and east-facing mountains. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Middle cobbly silt loam, 10 to 30 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 20 to 30 percent slopes.

This soil is used for range, wildlife habitat, and water supply. Capability unit VIs-M, nonirrigated; Mountain Stony Loam range site.

Broad cobbly loam, 30 to 60 percent slopes (BSG).—This soil is on north- and east-facing mountains. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Manila loam, 25 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes.

This soil is used for range, wildlife habitat, and water supply. Capability unit VIIs-M, nonirrigated; Mountain Stony Loam range site.

Broad-Manila association, steep (BTG).—This mapping unit is on the mountain areas east of Blue Creek valley. It consists of about 60 percent Broad cobbly loam, 30 to 60 percent slopes, and 30 percent Manila loam, 25 to 60 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 10 to 20 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this association are intermingled. The Broad soil is on very steep, north- and east-facing mountains. The Manila soil also is on very steep, north- and east-facing slopes, but slopes are slightly concave. Both soils have a cover of bluebunch wheatgrass, big sagebrush, yellowbrush, Sandberg bluegrass, and serviceberry.

The soils in this association are used for range, wildlife habitat, and water supply. The Broad soil is in capability unit VIIs-M, nonirrigated; Mountain Stony Loam range site. The Manila soil is in capability unit VIIe-M, nonirrigated; Mountain Loam range site.

Broad-Middle association, steep (BUG).—This mapping unit is mostly on the mountains east of Blue Creek valley, but a small acreage is on the east-facing slopes of the Promontory Mountains. It consists of about 60 percent Broad cobbly loam, 30 to 60 percent slopes, and 30 percent Middle cobbly silt loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Manila loam, 25 to 60 percent slopes; Sandall cobbly silt loam, 30 to 60 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

The Broad soil is on very steep, mainly north- and east-facing mountains. The Middle soil is on very steep, mainly south- and west-facing mountains. Both soils have a cover of bluebunch wheatgrass, big sagebrush, yellowbrush, Sandberg bluegrass, serviceberry, and annual grasses. The profile of this Broad soil is the one described as representative for the Broad series.

Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat and, to a limited extent, water supply. The Broad soil is in capability unit VIIs-M, nonirrigated; Mountain Stony Loam range site. The Middle soil is in capability unit VIIe-U, nonirrigated; Upland Loam range site.

Broad-Smarts association, steep (BVG).—This mapping unit is on very steep mountains. It consists of about 60 percent Broad cobbly loam, 30 to 60 percent slopes, and 30 percent Smarts loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Manila loam, 25 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; Yeates Hollow cobbly clay loam, 30 to 60 percent slopes; and Rock outcrop. These included areas make up about 10 percent of the total acreage.

The Broad soil is on south- and east-facing mountain slopes under a cover of big sagebrush, bluebunch wheatgrass, serviceberry, cheatgrass, and yellowbrush. The Smarts soil is on north- and west-facing mountain slopes and mountain ravines. Its plant cover is an overstory of maple and chokecherry and an understory of grasses, shrubs, and annuals.

Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat, and, to a limited extent, water supply. The Broad soil is in capability unit VIIs-M, nonirrigated; Mountain Stony Loam range site. The Smarts soil is in capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site.

Collett Series

The Collett series consists of somewhat poorly drained soils. These soils are on low lake terraces and lake plains in the Bear River valley south and west of Tremonton. They formed in calcareous, fine-textured, mixed lake sediments derived dominantly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is Kentucky bluegrass, Great Basin wildrye, saltgrass, foxtail, and sedges. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 130 to 145 days. Elevations range from 4,250 to 4,350 feet.

In a representative profile, the surface layer is grayish-brown silty clay loam about 14 inches thick. The subsoil is light brownish-gray silty clay about 9 inches thick. The substratum is white silty clay between depths of 23 and 30 inches and then is light-gray and pink silty clay loam that extends to a depth of 66 inches. The surface layer is strongly alkaline and slightly to moderately calcareous, the subsoil is strongly alkaline and strongly calcareous, and the substratum is very strongly alkaline and strongly calcareous. A layer of strong lime accumulation is at a depth of 23 inches.

Permeability is slow to a depth of 23 inches and is moderately slow below that depth. The rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots extend to a depth of 60 inches or more where the soils are drained.

Collett soils are used for irrigated crops.

Representative profile of Collett silty clay loam, in a cultivated field, 400 feet south and 600 feet west of the northeast corner of section 12, T. 11 N., R. 4 W., about 3 miles west of Tremonton:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, subangular blocky structure that parts to weak, medium and fine, granular; hard, firm, sticky and plastic; common very fine and fine roots; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

A1—7 to 14 inches, grayish-brown (10YR 5/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, firm, very sticky and very plastic; common very fine and fine roots; many very fine and fine pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

B2—14 to 23 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (2.5Y 4/2) when moist; moderate, fine and medium, subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; many fine and medium pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, wavy boundary.

C1ca—23 to 30 inches, white (10YR 8/2) silty clay, grayish brown (2.5Y 5/2) when moist; many, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, very sticky and plastic; few very fine roots; common fine and few medium pores; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C2ca—30 to 45 inches, light-gray (10YR 7/2) heavy silty clay loam, brown (10YR 5/3) when moist; many, coarse, prominent, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; many fine and few medium pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, wavy boundary.

C3—45 to 66 inches, pink (7.5YR 7/4) heavy silty clay loam, brown (7.5YR 5/4) when moist; common, medium, prominent, olive-gray (5Y 5/2) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; few very fine pores; strongly calcareous, some lime veins; strongly alkaline (pH 8.5).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 17 to 30 inches. Between depths of 10 and 40 inches, the texture averages silty clay and the content of clay ranges from 35 to 44 percent. The soils are usually moist, and unlike most other soils in the survey area, in most years they are not dry in all parts between depths of 4 to 12 inches for as much as 60 consecutive days in summer.

In the A1 horizon, hue is 10YR or 2.5Y and chroma is 1 or 2. Texture is heavy silty clay loam or heavy silt loam. The A1 horizon is moderately alkaline to strongly alkaline and is slightly calcareous to moderately calcareous.

In the B2 horizon, hue is 10YR or 2.5Y and value is 4 or 5 when the soils are moist. Texture is silty clay or heavy silty clay loam. The B2 horizon is moderately calcareous to strongly calcareous and is moderately alkaline to strongly alkaline.

In the Cca and C horizons hue is 7.5YR, 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and is 5 to 6 when they are moist; and chroma ranges from 2 to 4. Reaction is strongly alkaline to very strongly alkaline. In the Cca horizon, calcium carbonate equivalents range from 25 to 50 percent. Stratified lake-laid sediments are at a depth below 29 to 45 inches; the texture is mainly silty clay loam or silty clay, but there are layers of very fine sandy loam ¼ inch to 2 inches thick. Depth to the water table ranges from 30 to 40 inches where the soils are not drained and from 40 to 60 inches where they are drained. Distinct mottles are at a depth below 22 to 32 inches; they range from few to many and are fine to medium.

Collett silty clay loam (Co).—This soil is on broad, low lake terraces and lake plains in the Bear River valley south and west of Tremonton. Slopes most commonly are less than 1 percent but range from 0 to 2 percent. Runoff is slow, and the hazard of erosion is slight. Most areas of this soil have been leveled and tile drained. Where the soil is not drained, the water table is at a depth of 40 to 60 inches or more.

Included with this soil in mapping are small areas of Greenson silt loam, strongly alkali, and Honeyville silty clay loam.

This Collett soil is used for irrigated alfalfa, small grains, corn for silage, sugar beets, and irrigated pasture. Capability unit IIIw-25, irrigated; Wet Meadow range site.

Collinston Series

The Collinston series consists of well-drained soils. These soils are on high lake terraces and terrace escarpments near the communities of Collinston and Beaver Dam. They formed in calcareous alluvium, conglomerate of the Salt Lake geologic formation, and mixed lake sediments derived from light-colored, tuffaceous sandstone and limestone. Slopes range from 6 to 30 percent. Vegetation is mainly bluebunch wheatgrass, slender wheatgrass, Great Basin wildrye, balsamroot, and buckwheat. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 120 to 130 days. Elevations range from 4,700 to 5,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 14 inches thick. The next layer, about 11 inches thick, is white silt loam that has an accumulation of lime. This is underlain by white silt loam that extends to a depth of 60 inches or more. The surface layer is moderately and strongly alkaline and is slightly and moderately calcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 10 to 12 inches for plant growth before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for nonirrigated crops and range.

Representative profile of Collinston silt loam, 10 to 30 percent slopes, in an area of Wheelon-Collinston silt loams, 10 to 30 percent slopes, in a cultivated field, 1,000 feet east and 300 feet north of the southwest corner of section 12, T. 12 N., R. 2 W., southeast of Beaver Dam:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; slightly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

A1—8 to 14 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; moderately calcareous; strongly alkaline (pH 8.6); abrupt, wavy boundary.

C1ca—14 to 25 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.8); diffuse, smooth boundary.

C2—25 to 44 inches, white (2.5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine and few medium

pores; strongly calcareous; strongly alkaline (pH 8.8); diffuse, smooth boundary.

C3—44 to 72 inches, white (2.5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 8 to 17 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 20 to 24 percent. The soils are usually moist but are dry in all parts between depths of 4 to 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma is 1 or 2. The A1 horizon is mildly alkaline to strongly alkaline and slightly calcareous to moderately calcareous. In the Cca horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soil is dry and from 4 to 6 when moist. Texture is mainly silt loam but may be silty clay loam. The Cca horizon is strongly alkaline to very strongly alkaline. In the C horizons hue is 2.5Y or 5Y.

In Box Elder County, Eastern Part, the Collinston soils are mapped only in complexes with the Wheelon soils. Soils of the two series are so closely intermingled that they cannot be separated at the scale used in mapping. To conserve these soils where they are used for crops, they must be treated with conservation measures required for the most restrictive soil.

Collinston-Wheelon silt loams, 6 to 10 percent slopes (CwD).—This mapping unit is in rolling topography on lake terraces having all aspects. It consists of about 55 percent Collinston silt loam, 6 to 10 percent slopes, and 35 percent Wheelon silt loam, 6 to 10 percent slopes. Included with these soils in mapping are small areas of Mendon silt loam, 6 to 10 percent slopes. This included soil makes up about 10 percent of the total acreage.

Soils of this complex are closely intermingled in rolling areas. The Collinston soil has slightly concave slopes, and the Wheelon soil has short, convex slopes and is on knolls and ridges. The plant cover on both soils consists mainly of bluebunch wheatgrass, slender wheatgrass, Great Basin wildrye, balsamroot, buckwheat, big sagebrush, and annual grasses.

Runoff is medium, and the hazard of erosion is moderate.

These soils are used for range and nonirrigated small grains. The Wheelon soil is the more erodible of the two soils. If the complex is used for crops, the Wheelon soil should determine the conservation measures needed for both soils. Capability unit VIe-U, nonirrigated; Upland Shallow Loam range site.

Cudahy Series

The Cudahy series consists of poorly drained soils that have a hardpan of indurated lime. These soils are on low lake terraces and lake plains in the area immediately west of Brigham City and Perry. They formed in very strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas consists mainly of wiregrass, sedges, Kentucky bluegrass, saltgrass, and foxtail. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 15 to 17 inches, and the frost-free period is 140 to 155 days. Elevation ranges from 4,225 to 4,320 feet.

In a representative profile, the surface layer is gray silt loam about 10 inches thick. The next layer is light-gray silt loam 19 inches thick. This is underlain by a hardpan of white, indurated lime about 15 inches thick. Below the hardpan is light-gray silty clay loam that extends to a depth of 60 inches. The surface layer is moderately alkaline and strongly calcareous, and the underlying layers are moderately alkaline and very strongly calcareous.

Permeability is moderate above the hardpan but is very slow in the hardpan. The rate of water intake is slow. Available water holding capacity is about 5 to 6 inches above the hardpan. Roots penetrate to the hardpan.

These soils are used mainly for native pasture, but some areas are used for irrigated crops.

Representative profile of Cudahy silt loam, in pasture, 1,120 feet east and 135 feet north of the west quarter corner of section 23, T. 9 N., R. 2 W., about three-fourths of a mile west of Box Elder High School, near Brigham City:

O1—1 inch to 0, decaying leaves, stems, and similar organic materials.

A1—0 to 10 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; weak, medium and coarse, subangular blocky structure that parts to moderate, fine, granular; hard, friable, nonsticky and slightly plastic; many fine and very fine roots; strongly calcareous; moderately alkaline (pH 8.0); clear, wavy boundary.

C1ca—10 to 23 inches, light-gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and slightly plastic; many fine and very fine roots; many very fine pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); gradual, irregular boundary.

C2ca—23 to 29 inches, light-gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) when moist; massive; extremely hard, extremely firm, nonsticky and nonplastic; many very fine pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); gradual, irregular boundary.

C3cam—29 to 44 inches, white (10YR 8/2), indurated lime hardpan, light brownish gray (10YR 6/2) when moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles; very strongly calcareous; moderately alkaline (pH 8.4).

C4g—44 to 60 inches, light-gray (5Y 7/1) light silty clay loam, gray (5Y 5/1) when moist; many, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few fine pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth to the hardpan ranges from 23 to 40 inches. Average texture between a depth of 10 inches and the hardpan is silt loam. The soils are usually moist, and in most years they are not dry in all parts of the 4- to 12-inch depth for as long as 60 consecutive days in summer. Depth to the water table fluctuates with the season but is mainly 20 to 30 inches unless the soils are drained.

In the Al horizon, value is 2 or 3 when the soils are moist; chroma is 1 or less. The Al horizon ranges from 8 to 12 inches in thickness. In the Cca and C horizons, hue is 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 1 or 2. Texture below the hardpan is light silty clay loam or light silty clay. Mottles below the hardpan are distinct, range from few to many, and are fine to medium.

Cudahy silt loam (Cy).—This soil is in small areas on west-facing low terraces and lake plains west of Brigham City and Perry. Slopes are slightly concave and most commonly are less than 1 percent, but they range from 0 to 3 percent. Runoff is slow to ponded, and the hazard of erosion is none to slight.

Included with this soil in mapping are small areas of Roshe Springs silt loam.

This Cudahy soil is used mainly for native pasture that is occasionally mowed for hay. A small area of this soil has been drained and is used for irrigated alfalfa, small grains, sugar beets, corn for silage, and irrigated pasture. Capability unit IVw-28, irrigated; Wet Meadow range site.

Dagor Series

The Dagor series consists of well-drained soils. These soils are on broad alluvial fans between the cities of Perry and Willard. They formed in alluvium derived from quartzite, sandstone, gneiss, and schist. Slopes range from 3 to 6 percent. The vegetation in noncultivated areas consists of big sagebrush, bluebunch wheatgrass, yellowbrush, yarrow, and annual grasses. Mean annual air temperature ranges from 49° to 51° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 100 to 160 days. Elevation ranges from 4,300 to 4,400 feet.

In a representative profile, the surface layer is dark grayish-brown loam about 21 inches thick. The underlying layers, extending to a depth of 60 inches, are light brownish-gray loam. The surface layer is mildly alkaline and noncalcareous to slightly calcareous. The next layers are moderately alkaline and slightly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 11 inches to a depth of 5 feet. The water-supplying capacity is 11 to 12 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for irrigated crops.

Representative profile of Dagor loam, 3 to 6 percent slopes, in a cultivated field, 2,350 feet south and 300 feet west of the north quarter corner of section 14, T. 8 N., R. 2 W., about 1½ miles north of Willard:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; hard, friable, nonsticky and slightly plastic; common fine and very fine roots; 5 percent gravel; noncalcareous to slightly calcareous; mildly alkaline (pH 7.4); abrupt, smooth boundary.

A1—9 to 21 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, nonsticky and slightly plastic; few fine and very fine roots; common fine and very fine pores; 5 percent gravel; noncalcareous to slightly calcareous; mildly alkaline (pH 7.6); clear, smooth boundary.

C1—21 to 31 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; massive; hard, friable, nonsticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

C2—31 to 60 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many fine and very fine pores; slightly calcareous; moderately alkaline (pH 8.4).

The texture averages loam between depths of 10 and 40 inches. The content of gravel is as much as 10 percent throughout the profile. These soils are generally noncalcareous but may be slightly calcareous if they are recharged by irrigation water. The soils are usually moist but in most years are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist, and they are noncalcareous to slightly calcareous. The A1 horizon ranges from 20 to 24 inches in thickness. In the C horizon, hue is 2.5Y or 10YR. The C horizon is noncalcareous to slightly calcareous.

Dagor loam, 3 to 6 percent slopes (DaB).—This soil is on short, west-facing alluvial fans. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Draper loam, 0 to 3 percent slopes, and Wasatch gravelly sandy loam, 3 to 10 percent slopes.

This soil is used for irrigated stone fruits, apples, tomatoes, corn, peas, melons, alfalfa, small grains, and irrigated pasture. Capability unit IIe-1, irrigated; range site not assigned.

DeJarnet Series

The DeJarnet series consists of well-drained soils. These soils are on intermediate and high lake terraces and offshore bars. They formed in very gravelly alluvium or reworked lake sediment that was derived dominantly from quartzite and sandstone rocks but was slightly influenced by limestone. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, yellowbrush, cheatgrass, and annual weeds. Mean annual air temperature is 47° to 50° F. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,700 to 5,200 feet.

In a representative profile (fig. 2), the surface layer is dark grayish-brown gravelly silt loam about 10 inches thick. The subsoil is about 24 inches thick. It is dark grayish-brown gravelly silt loam in the upper part and brown very gravelly loam in the lower part. The substratum is pale-brown very gravelly loam that extends to a depth of 60 inches. The surface layer is mildly alkaline, the subsoil is mildly and moderately alkaline, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 5.5 to 7 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 9 to 11 inches. Roots penetrate to a depth of more than 60 inches, but most of them are at a depth of 20 to 30 inches.

These soils are used for nonirrigated crops.

Representative profile of DeJarnet gravelly silt loam, 1 to 6 percent slopes, in a cultivated field, 1,050 feet west and 240 feet south of the east quarter corner of section 11, T. 14 N., R. 6 W., about 8 miles north and 2 miles west from the Valley turnoff on Interstate Highway I–80:

Ap1—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; 25 percent gravel; mildly alkaline (pH 7.8); clear, smooth boundary.

Ap2—4 to 10 inches, dark grayish-brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few very fine pores; 25 percent gravel; mildly alkaline (pH 7.8); gradual, smooth boundary.

B21—10 to 20 inches, dark grayish-brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, firm, slightly sticky and plastic; few fine roots; many very fine pores; 30 percent gravel; mildly alkaline (pH 7.8); gradual, wavy boundary.

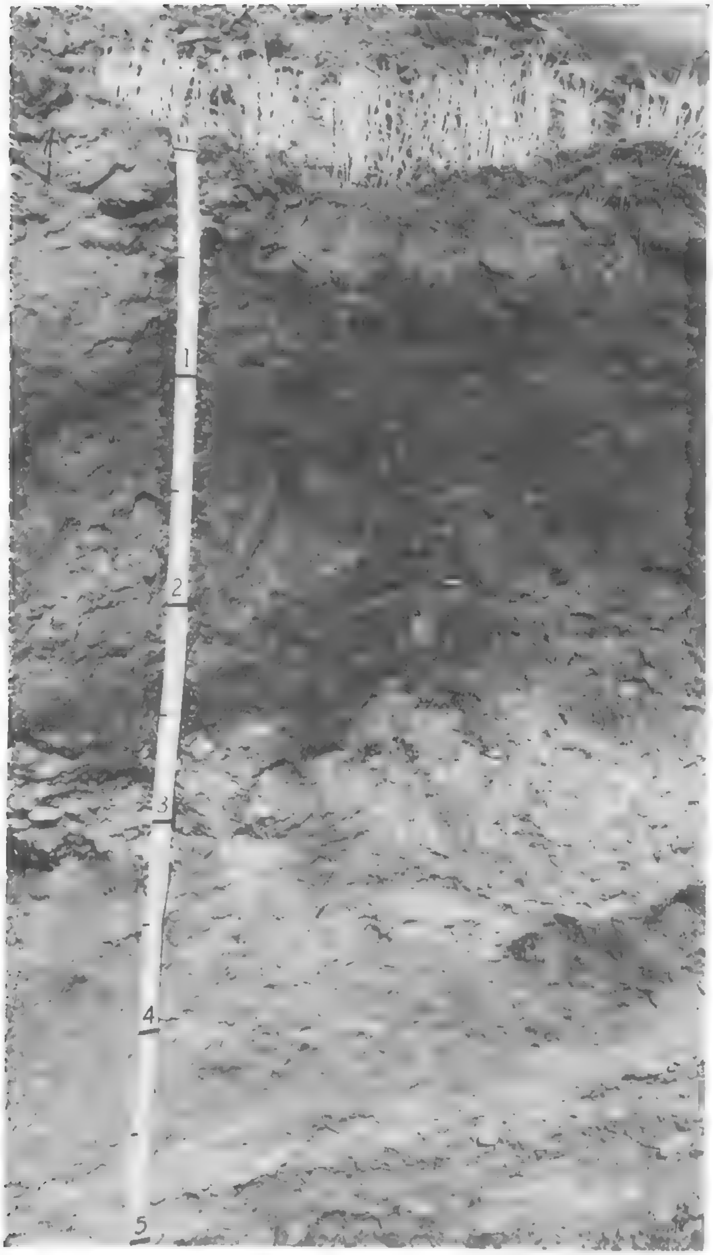

Figure 2.—**Profile of DeJarnet gravelly silt loam, 1 to 6 percent slopes.**

B22—20 to 28 inches, brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3) when moist; moderate, fine, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many very fine pores; common thin clay films on ped faces; 55 percent gravel; moderately alkaline (pH 7.9); gradual, wavy boundary.

B23—28 to 34 inches, brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; few thin clay films on ped faces; 70 percent gravel and cobblestones; moderately alkaline (pH 8.0); gradual, wavy boundary.

Cca—34 to 60 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) when moist; massive; hard, very friable, nonsticky and nonplastic; few fine roots; common very fine pores; 80 percent gravel and cobblestones; strongly calcareous, weakly cemented in places; strongly alkaline (pH 8.5).

The depth to very gravelly material ranges from 14 to 20 inches. Coarse fragments are mainly gravel ½ to 1½ inches in diameter, but there are some cobblestone-size fragments of quartzite, sandstone, and limestone. Between depths of 10 and 40 inches, the texture averages very gravelly loam, content of clay ranges from 18 to 22 percent, and content of coarse fragments ranges from 40 to 70 percent. Depth to the horizon of carbonate accumulation ranges from 20 to 36 inches. The soils are usually moist but in most years are dry in all parts between depths 4 and 12 inches for more than 60 consecutive days in summer.

In the A horizon value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is gravelly silt loam or gravelly heavy silt loam, and content of gravel is 20 to 35 percent. Reaction is neutral to moderately alkaline. The A1 horizon ranges from 7 to 14 inches in thickness.

In the B2 horizon, value is 4 or 5 when the soils are dry and 2 and 3 when they are moist; chroma is 2 or 3. Texture is very gravelly loam or gravelly silt loam, and the content of gravel and cobblestones is 40 to 60 percent. Clay films range from none or few to common and are in pores or on ped faces. Reaction is neutral to moderately alkaline. The B2 horizon ranges from 13 to 24 inches in thickness.

In the Cca horizon, hue is 10YR or 7.5YR; value ranges from 6 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is very gravelly loam, very gravelly sandy loam, or gravelly loam. The content of coarse fragments is 40 to 90 percent. Reaction is moderately alkaline to strongly alkaline. The Cca horizon is moderately calcareous to strongly calcareous and weakly cemented in some places.

DeJarnet gravelly silt loam, 1 to 6 percent slopes (DgB).—This soil is on offshore bars and intermediate and high lake terraces. Slopes are slightly convex and short in length. A profile of this soil is the one described as representative for the DeJarnet series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes, and Hupp gravelly silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated wheat. Capability unit IVs–U4, nonirrigated; range site not assigned.

DeJarnet gravelly silt loam, 6 to 10 percent slopes (DgD).—This soil is on offshore bars and intermediate and high lake terraces. Slopes are slightly convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; Sterling gravelly loam, 6 to 20 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated wheat. Some areas are used for range. Capability unit IVs–U4, nonirrigated; range site not assigned.

Draper Series

The Draper series consists of somewhat poorly drained soils. These soils are on alluvial fans in the area west of Brigham City and Perry. They formed in noncalcareous, mixed alluvium derived dominantly from quartzite, gneiss, schist, and granite. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is mainly sedges, wiregrass, and Kentucky bluegrass. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 15 to 17 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,225 to 4,360 feet.

In a representative profile, the surface layer is dark-gray and gray loam about 26 inches thick. The underlying layers are gray and light-gray heavy loam that extends to a depth of 60 inches. These soils are moderately alkaline and slightly calcareous throughout.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. Roots penetrate easily to the water table.

These soils are used for irrigated crops.

Representative profile of Draper loam, 0 to 3 percent slopes, in range, 450 feet south and 300 feet east of the west quarter corner of section 14, T. 8 N., R. 2 W., about 1½ miles northwest of Willard:

Ap—0 to 8 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.

A11—8 to 15 inches, dark-gray (10YR 4/1) heavy loam, black (10YR 2/1) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); gradual, wavy boundary.

A12—15 to 26 inches, gray (10YR 5/1) heavy loam, very dark gray (10YR 3/1) when moist; few, fine, faint, dark-brown (7.5YR 3/3) mottles; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

C1—26 to 35 inches, gray (10YR 6/1) heavy loam, very dark grayish brown (10YR 3/2) when moist; common, fine, distinct, reddish-yellow (7.5YR 6/8) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

C2—35 to 44 inches, light-gray (10YR 7/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; many, fine, distinct, reddish-yellow (7.5YR 6/8) mottles; massive; very hard, firm, slightly sticky and slightly plastic; many very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, irregular boundary.

C3—44 to 60 inches, light-gray (2.5Y 7/2) heavy loam, olive brown (2.5Y 4/3) when moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, friable, slightly sticky and slightly plastic; common very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4).

In places the entire profile is 5 to 15 percent fine gravel. Between depths of 10 and 40 inches, the texture averages heavy loam and the content of clay ranges from 22 to 27 percent. The soils are usually moist, and in most years they are not dry in all parts at depths between 4 to 12 inches for as much as 60 consecutive days in summer. Depth to the water table ranges from 30 to 42 inches unless the soils are drained.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. Texture is loam or heavy loam. The A1 horizon is noncalcareous to slightly calcareous and ranges from 24 to 30 inches in thickness.

In the C horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 1 to 3. Texture is heavy loam or loam. The C horizon is noncalcareous to slightly calcareous. Distinct mottles are below a depth of 26 inches and are common to many and fine to medium.

Draper loam, 0 to 3 percent slopes (DrA).—This soil is in small areas on west-facing alluvial fans west of Brigham City and Perry. Slopes are short. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Dagor loam, 3 to 6 percent slopes, James Canyon loam, 0 to 3 percent slopes, and Roshe Springs silt loam.

This Draper soil is used for irrigated small grains, corn for silage, alfalfa, sugar beets, irrigated pasture, tomatoes, and truck crops. Capability unit IIw–2, irrigated; range site not assigned.

Drum Series

The Drum series consists of well-drained soils. These soils are on lake plains and low lake terraces in the extreme southwestern part of the survey area. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. Vegetation consists of greasewood, shadscale, pickleweed, kochia, rubber rabbitbrush, annual mustard, cheatgrass, and some big sagebrush. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 6 to 8 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,230 to 4,450 feet.

In a representative profile, the surface layer is light-gray silt loam about 5 inches thick. The subsoil is very pale brown silt loam about 7 inches thick. The substratum is very pale brown and white silt loam in the upper part and, in the lower part, is light-gray silty clay loam that extends to a depth of 60 inches. The surface layer and subsoil are very strongly alkaline, and the substratum is strongly alkaline. These soils are strongly calcareous throughout. A layer of strong lime accumulation is at a depth of 12 inches.

Permeability is moderate, and the rate of water intake is moderate. Because of the high salt content, the water available to plants is only about 3 to 7 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 11 inches to that depth. Roots penetrate to a depth of more than 60 inches, but most of them are in the top 18 inches of the soil.

These soils are used for range.

Representative profile of Drum silt loam, in range, 100 feet north and 1,600 feet east of the southeast corner of section 28, T. 12 N., R. 9 W., about 2 miles northeast of Locomotive Springs Wildlife Refuge headquarters:

A1—0 to 5 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, platy structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine vesicular pores; strongly calcareous; very strongly alkaline (pH 9.1); abrupt, smooth boundary.

B2—5 to 12 inches, very pale brown (10YR 7/4) silt loam, brown (7.5YR 5/4) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine vesicular pores; strongly calcareous; very strongly alkaline (pH 9.2); clear, smooth boundary.

C1ca—12 to 18 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) when moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many fine and very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, wavy boundary.

C2ca—18 to 24 inches, white (2.5Y 8/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; hard, very friable, slightly sticky and slightly plastic; many fine and very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); diffuse, smooth boundary.

C3—24 to 36 inches, white (5Y 8/2) heavy silt loam, light olive gray (5Y 6/2) when moist; massive; hard, friable, slightly sticky and plastic; many fine and very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.

C4—36 to 46 inches, very pale brown (10YR 7/3) light silty clay loam, yellowish brown (10YR 5/4) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); gradual, wavy boundary.

C5—46 to 60 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 10 to 16 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 18 to 25 percent. In places there are common to many distinct mottles at a depth below 36 inches. The salt content is as much as 1.25 percent in places. These soils are slightly to strongly affected by salts and moderately to strongly affected by alkali.

In the A1 horizon, value is 4 or 5 when the soils are moist, and chroma is 2 or 3. Texture ranges from silt loam to loam. Reaction is strongly alkaline or very strongly alkaline. The A1 horizon is moderately calcareous and is 4 to 7 inches thick.

In the B2 horizon, hue is 10YR or 7.5YR, value is 6 or 7 when the soils are dry, and chroma is 3 or 4. Reaction is strongly alkaline or very strongly alkaline. The B2 horizon is moderately calcareous to strongly calcareous and ranges from 6 to 9 inches in thickness.

In the Cca and C horizons, hue is 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silty clay loam, silt loam, or very fine sandy loam. Reaction is strongly alkaline or very strongly alkaline. The Cca and C horizons are moderately calcareous to strongly calcareous.

Drum silt loam (DU).—This soil is on broad lake plains and low lake terraces in the extreme southwestern part of the survey area. Slopes are most commonly less than 1 percent but range from 0 to 4 percent. Runoff is medium, and the hazard of erosion is moderate. Shallow gullies and sheet and rill erosion are common.

Included with this soil in mapping are small areas of Uffens silt loam.

This Drum soil is used for range. Capability unit VIIs-D8, nonirrigated; Desert Flats range site.

Eccles Series

The Eccles series consists of well-drained soils. These soils are on intermediate lake terraces. They formed in strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone rocks. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, big sagebrush, three-awn, Indian ricegrass, cheatgrass, annuals, and juniper. Crested wheatgrass has been planted in some areas (fig. 3). Mean annual air temperature is 47° to 50° F. Average annual percipitation ranges from 11 to 14 inches; and the frost-free period is 110 to 130 days. Elevation ranges from 4,550 to 4,900 feet.

In a representative profile, the surface layer is pale-brown fine sandy loam about 11 inches thick, and the subsoil is pale-brown fine sandy loam about 7 inches thick. The substratum is light-gray fine sandy loam and very fine sandy loam that extends to a depth of 62 inches. These soils are strongly calcareous. The surface layer and subsoil are moderately alkaline, and the substratum is strongly alkaline and very strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 7.5 to 8.5 inches to a depth of 5 feet. The water-supplying capacity is 8 to 10 inches before moisture is depleted. Roots extend to depth of more than 60 inches, but most of them are in the upper 30 inches of soil.

These soils are used mainly for nonirrigated crops.

Representative profile of Eccles fine sandy loam, 1 to 6 percent slopes, in a cultivated field, 2,000 feet east and 1,700 feet north of the southwest corner of section 27, T. 13 N., R. 8 W., in Hansel Valley, about one-half mile north of Bill Peterson ranch headquarters:

Ap—0 to 6 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine and medium, granular; soft, friable, nonsticky and nonplastic; common fine and very fine roots; strongly calcareous; moderately alkaline (pH 8.0); abrupt, smooth boundary.

A1—6 to 11 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure, but structure in the upper 2 inches of this horizon is thick platy; soft, friable, nonsticky and nonplastic; common fine roots; common very fine pores, strongly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

B2—11 to 18 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common fine and very fine roots; many very fine pores; strongly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.

C1ca—18 to 28 inches, light-gray (2.5Y 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2ca—28 to 45 inches, light-gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.

C3—45 to 62 inches, light-gray (2.5Y 7/2) light very fine sandy loam, light brownish gray (2.5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; soft, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 10 to 24 inches. Between depths of 10 and 40 inches, the texture averages fine sandy loam and the content of clay ranges from 15 to 18 percent. In places a small amount of gravel, ¼ to ¾ inch in diameter, is on the surface and throughout the profile. Many, thin-crusted, soft marine shells, ¼ to ½ inch in size, are found in places throughout the profile. The soils are usually dry in all parts between depths of 8 and 30 inches.

In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is fine sandy loam or light loam. The A1 horizon is moderately or strongly calcareous and is 5 to 11 inches thick.

Figure 3.—Crested wheatgrass growing on Eccles fine sandy loam, 1 to 6 percent slopes, in foreground. Juniper growing on Sandall cobbly silt loam, 30 to 60 percent slopes, on the mountains in the background. The soil on the sloping fans between the mountains and the lower lake terraces is mainly Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. Texture is very fine sandy loam, fine sandy loam, or sandy loam. In the B2 horizon, reaction is moderately alkaline or strongly alkaline and the soil is moderately or strongly calcareous. In some profiles, carbonate accumulation begins in the lower part of the B2 horizon. Thickness of the B2t horizon ranges from 5 to 14 inches.

In the Cca and C horizons, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and is 5 or 6 when they are moist; and chroma is 2 or 3. Texture is very fine sandy loam, sandy loam, or loamy sand. The Cca and C horizons are strongly alkaline or very strongly alkaline.

Eccles fine sandy loam, 0 to 1 percent slopes (EcA).—This soil is on south- and west-facing slopes on intermediate lake terraces. Slopes are medium in length. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Stingal loam, 1 to 6 percent slopes; and Thiokol silt loam, 0 to 1 percent slopes.

This soil is used mainly for nonirrigated small grains and alfalfa. Some areas are used for wildlife habitat. Capability unit IVc-U, nonirrigated; range site not assigned.

Eccles fine sandy loam, 1 to 6 percent slopes (EcB).—This soil is on south- and west-facing slopes on intermediate lake terraces. Slopes are long and slightly convex. A profile of this soil is the one described as representative for the Eccles series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 0 to 1 percent slopes; Stingal loam, 1 to 6 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains and alfalfa. Some areas are used for wildlife habitat. Capability unit IVe-UZ, nonirrigated; range site not assigned.

Eccles fine sandy loam, 6 to 10 percent slopes (EcD).—This soil is on south- and west-facing slopes on intermediate lake terraces. Slopes are medium in length and slightly convex. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Stingal loam, 6 to 10 percent slopes; and Windmill gravelly loam, 6 to 10 percent slopes.

This soil is used chiefly for nonirrigated small grains. Some areas are used for wildlife habitat. Capability unit IVe-UZ, nonirrigated; range site not assigned.

Eccles Series, Sandy Variant

The Eccles series, sandy variant, consists of well-drained soils. These soils are on intermediate lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone and partly from shore deposits that have been reworked by wind. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of big sagebrush, Indian ricegrass, bluebunch wheatgrass, cheatgrass, and annuals. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 110 to 130 days. Elevations range from 4,550 to 4,850 feet.

In a representative profile, the surface layer is pale-brown loamy sand about 8 inches thick, and the subsoil is pale-brown sandy loam about 18 inches thick. The substratum is very pale brown loamy very fine sand, loamy fine sand, and loamy sand that extends to a depth of 64 inches. The surface layer and subsoil are moderately alkaline and moderately calcareous. The substratum is moderately alkaline or strongly alkaline and strongly calcareous.

Permeability is rapid, and the rate of water intake is rapid. Available water holding capacity is 5 to 6 inches to a depth of 5 feet. The water-supplying capacity is 7 to 8 inches before moisture is depleted. Roots may extend to a depth of more than 60 inches, but most roots are in the upper 36 inches of the soil.

These soils are used mainly for nonirrigated crops. Some areas are used for range and wildlife habitat.

Representative profile of Eccles loamy sand, sandy variant, 1 to 6 percent slopes, in a cultivated field, 2,200 feet east and 1,500 feet north of the southwest corner of section 18, T. 13 N., R. 5 W., about 3 miles northwest of Howell Post Office:

Ap—0 to 8 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; soft, very firable; common very fine roots; moderately calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

B21—8 to 16 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 4/3) when moist; weak, medium and coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few fine tubular pores; moderately calcareous; moderately alkaline (pH 8.4); gradual, wavy boundary.

B22—16 to 26 inches, pale-brown (10YR 6/3) light sandy loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few fine tubular pores; moderately calcareous; moderately alkaline (pH 8.4); gradual, wavy boundary.

C1ca—26 to 37 inches, very pale brown (10YR 7/3) loamy very fine sand, pale brown (10YR 6/3) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few fine tubular pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); gradual, wavy boundary.

C2ca—37 to 49 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) when moist; massive; soft, very friable; few fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5); gradual, wavy boundary.

C3—49 to 64 inches, very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) when moist; massive; soft, very friable; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Depth to the horizon of carbonate accumulation ranges from 18 to 26 inches. Texture averages light sandy loam between depths of 10 to 40 inches. In places, few, thin-crusted, soft marine shells that range from 1/4 to 1/2 inch in diameter are found throughout the profile. The soils are usually dry in all parts between depths of 8 to 24 inches.

In the A1 horizon, chroma is 2 or 3. This horizon is loamy sand or light sandy loam and ranges from 6 to 8 inches in thickness. In the B2 horizon, value is 4 or 5 when the soils are moist. Texture is sandy loam or light sandy loam. The B2 horizon is 13 to 18 inches thick. In the Cca and C horizons, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 5 or 6 when they are moist; and chroma is 2 or 3. Texture is loamy very fine sand or loamy sand. Reaction is moderately alkaline to very strongly alkaline.

Eccles loamy sand, sandy variant, 1 to 6 percent slopes (ElB).—This soil is on east-facing slopes on intermediate lake terraces and has been reworked by wind action. Slopes are short. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife habitat. Capability unit IVs-UZ, nonirrigated; range site not assigned.

Elzinga Series

The Elzinga series consists of well-drained soils. These soils are on mountain slopes and alluvial fans. They formed in colluvium and alluvium derived mainly from sandstone and quartzite. Slopes range from 25 to 70 percent. Vegetation consists of maple, chokecherry, snowberry, western coneflower, mountain brome, and bearded wheatgrass. Mean annual air temperature ranges from 40° to 45° F. Average annual precipitation ranges from 20 to 26 inches, and the frost-free period is 70 to 100 days. Elevations range from 5,200 to 7,500 feet.

In a representative profile, the surface layer is very dark gray silt loam and loam about 24 inches thick. The subsurface layer is pale-brown very gravelly silt loam about 29 inches thick. The subsoil is light-brown gravelly clay loam that extends to a depth of more than 60 inches. These soils are slightly acid throughout.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 7 to 9 inches

to a depth of 5 feet. The water-supplying capacity is 13 to 18 inches before moisture is depleted. Roots extend to a depth of 60 inches or more.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Elzinga silt loam, 50 to 70 percent slopes, in an area of Foxol-Elzinga association, steep, in range, 1,100 feet west and 450 feet south of the northeast corner of section 32, T. 9 N., R. 1 W., east of Brigham City:

O1—1 inch to 0, decomposing leaves and twigs.

A11—0 to 10 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots and few coarse roots; 10 percent gravel; slightly acid (pH 6.4); gradual, smooth boundary.

A12—10 to 24 inches, very dark gray (10YR 3/1) heavy loam, black (10YR 2/1) when moist; weak, medium and coarse, subangular blocky structure that parts to moderate, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots and few coarse roots; common very fine and micro pores; 10 percent gravel; slightly acid (pH 6.3); gradual, irregular boundary.

A2—24 to 53 inches, pale-brown (10YR 6/3) very gravelly silt loam, brown (10YR 4/3) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; few fine pores; 55 percent gravel and cobblestones; slightly acid (pH 6.2); diffuse, irregular boundary. Tongues from this horizon extend as much as 6 inches into the B2t horizon.

B2t—53 to 64 inches, light-brown (7.5YR 6/3) gravelly clay loam, brown (7.5YR 4/4) when moist; strong, coarse, subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine roots; common fine and very fine pores; many moderately thick clay films on ped faces; 35 percent gravel; common fine manganese concretions; slightly acid (pH 6.2).

The solum ranges from 48 to more than 60 inches in thickness. Content of gravel in the A1 horizon ranges from 10 to 20 percent. Content of gravel and cobblestones in the A2 horizon ranges from 55 to 70 percent, and content of gravel and cobblestones in the B2t horizon ranges from 35 to 70 percent. The soils are usually moist at depths between 4 and 12 inches, but are dry for 60 to 90 consecutive days in the summer in most years.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma is 1 or 2. Texture is silt loam or gravelly silt loam. The A1 horizon is slightly acid or medium acid and is 24 to 30 inches thick. In the A2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and is 3 or 4 when they are moist; and chroma is 3 or 4. Texture is very gravelly silt loam or very cobbly light silty clay loam. Reaction is medium or slightly acid, and thickness of the A2 horizon ranges from 13 to 30 inches.

In the B2t horizon, hue is 7.5YR or 5Y; value is 3 or 4 when the soils are moist; and chroma is 3 or 4. Texture is gravelly clay loam or very gravelly clay loam. Reaction is medium acid or slightly acid. Clay films in the B2t horizon range from thin to thick on ped faces.

Elzinga-Agassiz association, steep (EMF).—This mapping unit is on the mountains near Mantua. It consists of about 50 percent Elzinga silt loam, 25 to 50 percent slopes, and 40 percent Agassiz very stony loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Maughan silt loam, 25 to 50 percent slopes, and Picayune gravelly loam, 40 to 70 percent slopes. These included soils make up about 10 percent of the total acreage.

The Elzinga soil is in pockets and draws under maple and grasses. Slopes are concave. The Agassiz soils are on mountain slopes and ridgetops under bluebunch wheatgrass and big sagebrush. Slopes are convex.

Runoff is medium on these soils, and the hazard of erosion is moderate. Elevations range from 5,500 to 7,500 feet.

The soils of this association are used for range, wildlife habitat, and water supply. Elzinga loam is in capability unit VIIe–M, nonirrigated; Mountain Loam (Shrub) range site. Agassiz loam is in capability unit VIIs–M, nonirrigated; Mountain Shallow Loam range site.

Elzinga-Maughan complex, 25 to 50 percent slopes (ENF).—This complex is on the mountains northwest of Mantua. It consists of about 45 percent Elzinga silt loam, 25 to 50 percent slopes, and 35 percent Maughan silt loam, 25 to 50 percent slopes. Included with these soils in mapping are areas of Elzinga silt loam, 60 to 70 percent slopes; Goring clay loam, 25 to 40 percent slopes; and Agassiz very stony loam, 35 to 70 percent slopes. These included soils make up about 20 percent of the total acreage.

The Elzinga soils are on east- and west-facing mountain slopes and alluvial fans under maple and grasses. The Maughan soil is on north-facing mountain slopes under a dense cover of maple.

Runoff is medium on these soils, and the hazard of erosion is moderate.

The soils of this complex are used for range, wildlife habitat, and water supply. Capability unit VIIe–M, nonirrigated; Mountain Loam (Shrub) range site.

Etil Series

The Etil series consists of moderately well drained soils. These soils are on low lake terraces and in narrow, slightly elevated, beachline areas on the edge of salt playas bordering the Great Salt Lake. They formed in very strongly calcareous oolitic sand material. Slopes range from 1 to 6 percent. Vegetation consists of alkali sacaton, Indian ricegrass, greasewood, shadscale, big sagebrush, and cheatgrass. Mean annual air temperature ranges from 48° to 52° F. Average annual precipitation ranges from 8 to 10 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,210 to 4,230 feet.

In a representative profile, the surface layer is light brownish-gray loamy sand about 5 inches thick, and the underlying layers are light brownish-gray and light-gray sand and coarse sand that extend to a depth of about 60 inches. These soils are very strongly calcareous throughout. They are moderately alkaline in the surface layer and moderately alkaline to very strongly alkaline in the underlying layers.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity is about 4 to 5.5 inches before moisture is depleted. Roots extend to a depth of more than 60 inches in the soil.

These soils are used for range.

Representative profile of Etil loamy sand, 1 to 6 percent slopes, in range, 11 miles southwest of the Golden Spike National Monument, about 1,050 feet south and 600 feet east of the northwest corner of section 9, T. 8 N., R. 6 W.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; single grained; loose; common fine roots; 3 to 5 percent fine gravel; very strongly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

C1—5 to 11 inches, light brownish-gray (10YR 6/2) sand, grayish brown (10YR 5/2) when moist; single grained; loose; common fine roots; 3 to 5 percent fine gravel; very strongly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

C2—11 to 20 inches, light-gray (10YR 7/2) sand, light brownish gray (10YR 6/2) when moist; single grained; loose; few fine roots; 15 percent fine gravel; very strongly calcareous; strongly alkaline (pH 8.6); gradual, smooth boundary.

C3—20 to 32 inches, light-gray (10YR 7/2) sand, light brownish gray (10YR 6/2) when moist; single grained; loose; few fine roots; very strongly calcareous; very strongly alkaline (pH 9.2); diffuse, wavy boundary.

C4—32 to 60 inches, light-gray (10YR 7/2) coarse sand, light brownish gray (10YR 6/2) when moist; single grained; loose; few fine roots; very strongly calcareous; very strongly alkaline (pH 9.2).

Texture averages sand between depths of 10 to 40 inches. These soils are made up almost entirely of oolitic sand. They are usually moist but are dry in all parts between depths of 12 and 35 inches for more than 60 consecutive days in summer. Cemented oolitic aggregates, ¼ inch to 1½ inches in diameter, may be in any horizon and range from 1 to 15 percent by volume. Depth to the water table ranges from 24 to 60 inches or more, depending on nearness to and elevation of areas above the salt playas.

In the A1 horizon, value is 4 or 5 when the soils are moist; chroma is 2 or 3. Texture is loamy sand or loamy fine sand. This horizon is moderately alkaline or strongly alkaline and ranges from 5 to 7 inches in thickness.

In the C horizon, value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; chroma is 2 or 3. Texture is fine sand to sand. The C horizons are moderately alkaline to very strongly alkaline.

Etil loamy sand, 1 to 6 percent slopes (ETB).—This soil is mainly on rounded or long, narrow mounds. This soil occupies the beachline on the edge of the salt playas that border the Great Salt Lake. Slopes are convex, short, and abrupt and most commonly are 1 to 3 percent. Runoff is slow, and the hazard of erosion is slight. Soil blowing and deposition are common.

Included with this soil in mapping are small areas of Arave silty clay loam, Bram silt loam, and Palisade silt loam, 1 to 6 percent slopes.

This soil is used for range. Capability unit VIIs-S, nonirrigated; Semidesert Sand range site.

Fielding Series

The Fielding series consists of well-drained soils. These soils are on broad valley plains and alluvial fans adjacent to the valley plain in the Bear River valley. They formed in mixed lake sediments and local alluvium derived mainly from limestone, sandstone, and quartzite. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, Great Basin wildrye, big sagebrush, western wheatgrass, and annual grasses. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 125 to 155 days. Elevations range from 4,250 to 4,450 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 10 inches thick. The subsoil is pale-brown silt loam about 9 inches thick. The substratum is light-gray loam in the upper 6 inches, very pale brown and white silt loam in the middle 33 inches, and pink silty clay loam in the lower part, which extends to a depth of 60 inches or more. Below a depth of 34 inches, the substratum has thin strata of very fine sandy loam. The surface layer is moderately alkaline and slightly calcareous, and the subsoil is moderately alkaline and moderately calcareous or strongly calcareous. The substratum is strongly alkaline and strongly calcareous. A layer of strong lime accumulation is in the upper part of the substratum.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots penetrate to a depth of 60 inches or more.

These soils are used for irrigated crops.

Representative profile of Fielding silt loam, in a cultivated field, 800 feet north and 850 feet west of the south quarter corner of section 31, T. 13 N., R. 2 W., one-eighth mile northwest of the Fielding school near Fielding:

Ap1—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.

Ap2—6 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; slightly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.

B21—10 to 15 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots; few fine and medium interstitial pores; moderately calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

B22—15 to 19 inches, pale-brown (10YR 6/3) silt loam, grayish brown (10YR 5/2) when moist; weak, fine and medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); abrupt, wavy boundary.

C1ca—19 to 25 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.

C2ca—25 to 34 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine and micro interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); abrupt, wavy boundary.

C3—34 to 52 inches, white (10YR 8/2) silt loam, stratified with 1/16- to ¼-inch layers of very fine sandy loam, grayish brown (2.5Y 5/2) when moist; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, wavy boundary.

C4—52 to 66 inches, pink (7.5YR 7/4) silty clay loam, stratified with ¼- to 2-inch layers of very fine sandy loam, yellowish brown (10YR 5/4) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; massive; very hard, very firm, sticky and plastic; few very fine roots; common very fine interstitial pores; strongly calcareous; strongly alkaline (pH 9.0).

Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 20 to 25 percent. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in

summer. In places the soil below a depth of 32 inches is silt loam or silty clay loam that is stratified with 1/16- to 2-inch layers of very fine sandy loam. Depth to the water table ranges from 45 to 60 inches or more. In places distinct mottles are within 30 inches of the surface.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is silt loam or heavy silt loam. The A1 horizon is mildly alkaline to strongly alkaline and is 7 to 12 inches thick.

In the B2 horizon, value ranges from 4 to 6 when the soils are dry and from 3 to 5 when they are moist; chroma is 2 or 3. Texture in the B2 horizon is silt loam, loam, heavy silt loam, or heavy loam. The B2 horizon is mildly alklaine to very strongly alkaline, is slightly calcareous to strongly calcareous, and is 5 to 14 inches thick. The Cca and C horizons are strongly alkaline or very strongly alkaline.

Fielding silt loam (Fd).—This soil is on broad valley plains in the Bear River Valley north of Garland. A profile of this soil is the one described as representative for the Fielding series. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 125 to 140 days.

Included with this soil in mapping are small areas of Parleys silt loam, 0 to 1 percent slopes.

This Fielding soil is used for irrigated sugar beets, corn for silage, alfalfa, potatoes, small grains, and irrigated pasture. Capability unit IIc-2, irrigated; range site not assigned.

Fielding silt loam, warm (Fe).—This soil is on broad valley plains and alluvial fans adjacent to the valley plain. It is in the Bear River valley south of Garland. Slopes are 0 to 3 percent. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 155 days.

Included with this soil in mapping are small areas of Fridlo silt loam; Honeyville silty clay loam; and Timpanogos loam, 0 to 3 percent slopes. Also included are small areas of well drained to moderately well drained silt loam soils having slopes of 3 to 6 percent.

This soil is used for irrigated tomatoes, sugar beets, alfalfa, small grains, corn for silage, irrigated pasture, and truck crops. Capability unit I-1, irrigated; range site not assigned.

Forsgren Series

The Forsgren series consists of well-drained soils. These soils are on mountain foot slopes and colluvial fans in Whites Valley and the northern part of Blue Creek valley. They formed in alluvium and colluvium derived from sandstone, quartzite, and some limestone rocks. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Great Basin wildrye, Sandberg bluegrass, yellowbrush, yarrow, big sagebrush, and serviceberry. Mean annual air temperature ranges from 46° to 50° F. Average annual precipitation is 17 to 18 inches, and the frost-free period is 100 to 120 days. Elevations range from 5,175 to 5,500 feet.

In a representative profile, the surface layer is dark grayish-brown heavy silt loam about 8 inches thick. The subsoil is brown and light-brown silty clay and silty clay loam about 44 inches thick. The substratum is light-brown silt loam that extends to a depth of about 66 inches. The surface layer is mildly alkaline, and the subsoil is mildly alkaline to moderately alkaline. The lower part of the subsoil is slightly calcareous, and the substratum is strongly alkaline and moderately calcareous.

Permeability is slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 13 to 14 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated crops and range.

Representative profile of Forsgren silt loam, 10 to 20 percent slopes, in a cultivated field, 850 feet east of the west quarter corner of section 10, T. 14 N., R. 5 W., about 8 miles north and 1 mile east of the turnoff from Interstate 80N to Pocatello Valley:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, nonsticky and slightly plastic; common fine roots; few fine interstitial pores; mildly alkaline (pH 7.4); clear, smooth boundary.

A1—5 to 8 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; few fine interstitial pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

B21t—8 to 16 inches, brown (10YR 4/3) silty clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; very hard, firm, sticky and plastic; few fine roots; common fine interstitial pores; many thin clay films on ped faces; mildly alkaline (pH 7.4); gradual, wavy boundary.

B22t—16 to 34 inches, brown (7.5YR 5/4) light silty clay, brown (7.5YR 4/4) when moist; moderate, coarse, prismatic structure that parts to strong, medium and coarse, angular blocky; very hard, firm, sticky and very plastic; few fine roots; few fine interstitial pores; continuous thick clay films on ped faces; mildly alkaline (pH 7.8); gradual, wavy boundary.

B23t—34 to 38 inches, brown (7.5YR 5/4) heavy silty clay loam, brown (7.5YR 4/4) when moist; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and very plastic; few very fine roots; few fine interstitial pores; slightly calcareous, moderately alkaline (pH 8.2); gradual, wavy boundary.

B3t—38 to 52 inches, light-brown (7.5YR 6/4) silty clay loam, brown (7.5YR 4/4) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and very plastic; few very fine roots; few fine interstitial pores; many thin clay films on ped faces; slightly calcareous, lime is veined; moderately alkaline (pH 8.4); gradual, wavy boundary.

C—52 to 66 inches, light-brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; moderately calcareous, lime is veined; strongly alkaline (pH 8.9).

Thickness of the solum ranges from 40 to 55 inches. A few angular pebbles, 1/4 to 3/4 inch in diameter, are on the surface and throughout the profile. These soils have cracks, 1/2 to 1 1/2 inches wide, that extend to a depth of more than 20 inches in summer when they are dry. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. Reaction is neutral or mildly alkaline. The A1 horizon ranges from 5 to 11 inches in thickness.

In the B2t horizon, hue is 7.5YR or 10YR; value is 4 or 5 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. In the upper 6 to 10 inches of the B2t horizon only, the hue is 10YR and value is 4 when dry and 3 when moist. Texture is clay, silty clay, or heavy silty clay loam. Structure ranges from weak to strong and is medium to coarse prismatic. Clay films range from common to continuous and thin to thick on ped faces. Reaction ranges from neutral to strongly alkaline. Thickness of B2t horizon ranges from 20 to 40 inches.

In the C horizon, hue is 7.5YR or 10YR; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma is 3 or 4. Texture is silt loam, silty clay loam, or silty clay. Reaction is moderately alkaline or strongly alkaline. The C horizon is slightly calcareous to strongly calcareous below a depth of 40 inches.

Forsgren silt loam, 1 to 6 percent slopes (FgB).—This soil is on mountain foot slopes and colluvial fans in Whites Valley and Blue Creek valley. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Forsgren silt loam, 6 to 10 percent slopes, and Hendricks silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated crops, and wheat is the main crop grown. Capability unit IIIe–U, nonirrigated; range site not assigned.

Forsgren silt loam, 6 to 10 percent slopes (FgD).—This soil is on north- and east-facing slopes on colluvial fans and mountain foot slopes in Whites Valley and Hansel Valley. Slopes are medium in length and slightly concave. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; and Parleys silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe–U, nonirrigated; range site not assigned.

Forsgren silt loam, 10 to 20 percent slopes (FgE).—This soil is on north- and east-facing slopes on colluvial fans and mountain foot slopes in Blue Creek valley and Whites Valley. Slopes are short to medium in length and slightly concave. A profile of this soil is the one described as representative for the Forsgren series. Runoff is rapid, and the hazard of erosion is high. Moderate rill erosion is common, and shallow gullies have been formed in places.

Included with this soil in mapping are small areas of a deep, well-drained soil having a clay subsoil with prismatic structure and having slopes of 20 to 30 percent. Also included are small areas of Hendricks silt loam, 10 to 20 percent slopes, and Parleys silt loam, 10 to 20 percent slopes.

This Forsgren soil is used for nonirrigated crops. Wheat and alfalfa are the main crops grown. Capability unit IVe–U, nonirrigated; Upland Loam range site.

Foxol Series

The Foxol series consists of somewhat excessively drained soils. These soils occur on south- and west-facing mountain slopes near Brigham City. They formed in residuum and colluvium derived mainly from quartzite. Slopes range from 50 to 70 percent. Vegetation is mainly bluebunch wheatgrass, low sagebrush, buckwheat, and annual weeds. Mean annual air temperature ranges from 40° to 44° F. Average annual precipitation ranges from 18 to 26 inches, and the frost-free period is 75 to 100 days. Elevations range from 5,200 to 8,000 feet.

In a representative profile, the surface layer is brown gravelly light loam about 7 inches thick, the subsoil is brown gravelly loam about 6 inches thick, and the substratum is pale-brown very gravelly loam that overlies quartzite bedrock at a depth of about 17 inches. These soils are slightly acid throughout.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is about 2 inches. The water-supplying capacity is about 5 to 7 inches before moisture is depleted. Roots extend to bedrock.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of a Foxol gravelly loam, 50 to 70 percent slopes, in an area of Foxol-Rock outcrop complex, 50 to 70 percent slopes, in range, 1,700 feet east and 1,800 feet north of the southwest corner of section 8, T. 9 N., R. 1 W., east of Brigham City:

A1—0 to 7 inches, brown (10YR 5/3) gravelly light loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; 35 percent fine gravel; slightly acid (pH 6.4); clear, wavy boundary.

B2—7 to 13 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 35 percent gravel; slightly acid (pH 6.2); clear, irregular boundary.

C—13 to 17 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 90 percent gravel and cobblestones; slightly acid (pH 6.2); abrupt, irregular boundary.

R—17 inches, fractured quartzite rock.

Depth to bedrock ranges from 14 to 20 inches. The soils are usually moist but between depths of 4 and 12 inches are dry for 60 to 90 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma is 2 or 3. Texture of the A1 horizon is gravelly light loam or cobbly loam that is 35 to 50 percent gravel and cobblestones. Thickness of the A1 horizon ranges from 5 to 7 inches.

In the B2 horizon, value is 4 or 5 when the soils are dry and 3 or 4 when they are moist. The B2 horizon is gravelly loam or very cobbly heavy loam that is 35 to 70 percent gravel and cobblestones. It ranges from 6 to 7 inches in thickness.

In the C horizon, value is 3 or 4 when the soils are moist. The C horizon is very gravelly loam or very cobbly loam that is 80 to 90 percent gravel and cobblestones. Thickness ranges from 0 to 8 inches.

Foxol-Elzinga association, steep (FHG).—This mapping unit is on mountains southeast of Brigham City. It consists of about 45 percent Foxol gravelly loam, 50 to 70 percent slopes, and 35 percent Elzinga silt loam, 50 to 70 percent slopes. Included with these soils in mapping are small areas of a deep, well-drained, gravelly clay loam soil. This included soil makes up about 20 percent of the total acreage.

The Foxol soil is on east-, south-, and west-facing mountain slopes under a cover of bluebunch wheatgrass, low sagebrush, and buckwheat. The Elzinga soil is on east- and north-facing mountain slopes under a cover of maple, grasses, and annual weeds. A profile of the Elzinga soil is the one described as representative for the series.

Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat, and water supply. Foxol loam is in capability unit VIIs–M, nonirrigated; Mountain Shallow Loam range site. Elzinga loam is in capability unit VIIe–M, nonirrigated; Mountain Loam (Shrub) range site.

Foxol-Rock outcrop complex, 50 to 70 percent slopes (FRG).—This mapping unit is on the mountain slopes

east of Brigham City. It consists of about 60 percent Foxol gravelly loam, 50 to 70 percent slopes, and 40 percent Rock outcrop.

The Foxol soil and Rock outcrop are intermingled. The Foxol soil is generally on slightly concave, south- and west-facing mountain slopes. It has a plant cover of bluebunch wheatgrass, low sagebrush, and buckwheat. A profile of the Foxol soil is the one described as representative for the series. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is on south- and west-facing mountain slopes. It consists mainly of quartzite. Slopes are slightly convex.

This complex is used for range, wildlife habitat, and water supply. Capability unit VIIs–M, nonirrigated; Mountain Shallow Loam range site.

Francis Series

The Francis series consists of somewhat excessively drained soils. These soils are on low and intermediate lake terraces on the foot slopes of the Wasatch Mountains south of Willard. They formed in noncalcareous, wind-reworked, mixed lake sediments derived dominantly from quartzite, gneiss, schist, sandstone, and granite. Slopes range from 3 to 6 percent. The vegetation is noncultivated areas in sand dropseed, Indian ricegrass, three-awn grass, big sagebrush, rubber rabbitbrush, cheatgrass, and annual weeds. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,280 to 4,800 feet.

In a representative profile, the surface layer is brown loamy fine sand and loamy sand about 20 inches thick. The underlying layers are brown loamy sand that extends to a depth of 60 inches or more. The surface layer is moderately alkaline or mildly alkaline, and the underlying layers are mildly alkaline.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 4 to 5 inches to a depth of 5 feet. Roots penetrate easily to a depth of 60 inches.

These soils are used for irrigated crops and urban development.

Representative profile of Francis loamy fine sand, 3 to 6 percent slopes in an orchard, 2,350 feet west and 350 feet south of the northeast corner of section 11, T. 7 N., R. 2 W., about 3 miles south of Willard:

Ap—0 to 7 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, very friable; few fine and medium roots; moderately alkaline (pH 8.1); abrupt, smooth boundary.

A1—7 to 20 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine pores; mildly alkaline (pH 7.6); gradual, wavy boundary.

C1—20 to 27 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; weak, medium to coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine pores; mildly alkaline (pH 7.6); gradual, wavy boundary.

C2—27 to 60 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; massive; soft, very friable, nonsticky and nonplastic; mildly alkaline (pH 7.6).

Texture averages loamy sand between depths of 10 to 40 inches. In places a small amount of gravel, ¼ to ¾ inch in diameter, is on the surface and throughout the profile. The soils are usually moist, but in most years they are dry in all parts between depths of 12 and 35 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, chroma is 2 or 3. The A1 horizon ranges from 13 to 20 inches in thickness. In the C horizon, hue is 7.5YR or 10YR; value is 3 or 4 when the soils are moist; and chroma is 3 or 4. Texture is loamy sand or fine sand. In places clean gravel and sand are below a depth of 48 inches. Reaction is neutral or mildly alkaline. The C horizon is noncalcareous but in places is slightly calcareous to moderately calcareous below a depth of 60 inches.

Francis loamy fine sand, 3 to 6 percent slopes (FsB).—This soil is on long, west-facing slopes on low and intermediate lake terraces south of Willard. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

Included with this soil in mapping are small areas of Dagor loam, 3 to 6 percent slopes, and Wasatch gravelly sandy loam, 3 to 10 percent slopes.

This soil is used for irrigated crops and urban development. The main crops grown are peaches, apricots, apples, cherries, melons, alfalfa, corn for silage, tomatoes, and small grains. Capability unit IIIe–16, irrigated; range site not assigned.

Fresh Water Marsh

Fresh water marsh (FT) is a miscellaneous land type that occurs in natural depressions and manmade ponded areas. These marsh areas are on nearly level valley plains and along stream flood plains, where seasonal runoff accumulates and no surface drainage outlet is available. These areas are covered by fresh water most of the year, but when they are not covered they have a water table within 12 inches of the surface. A few areas of shallow open water about 10 to 50 feet in width are included. Texture of the soil material is silty clay loam to fine sandy loam. In some places there are layers of peat as much as 12 inches thick on the surface. Vegetation is dominantly sedges, cattails, and bulrushes.

Fresh water marsh is well suited to use as wildlife habitat. Many of the areas are being managed for use by migratory waterfowl and the trapping of muskrats. Some areas are used as range for cattle in winter. Capability unit VIIIw–2, nonirrigated; range site not assigned.

Fridlo Series

The Fridlo series consists of moderately well drained soils that are affected by alkali. These soils are on lake terraces and alluvial fans. They formed in reworked lake sediments and alluvium derived from many kinds of parent rocks. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is saltgrass, greasewood, alkali sacaton, annual mustard, and annual grasses. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 130 to 150 days. Elevations range from 4,220 to 4,600 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 9 inches thick. The subsoil is brown silt loam in the upper 6 inches, pale-brown silty clay in the middle 6 inches, and very pale brown silt loam in the

lower 8 inches. The substratum, extending to a depth of 60 inches, is light-gray or white silty clay loam. The surface layer and upper part of the subsoil are alkaline. The lower part of the subsoil and the substratum are very strongly alkaline. The soil varies from noncalcareous in part of the surface layer to strongly calcareous in the lower part of the subsoil and in the substratum.

Most roots are within a depth of 40 inches, although roots may extend to a depth of more than 60 inches.

These soils are used mainly for irrigated and nonirrigated crops.

Representative profile of Fridlo silt loam, in a cultivated field, 400 feet north and 1,050 feet west of the southeast corner of section 7, T. 12 N., R. 5 W., southwest of Howell:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few coarse roots and many fine roots; few fine pores; slightly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.

A1—6 to 9 inches, grayish-brown (10YR 5/2) heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few coarse roots and many fine roots; few fine pores; noncalcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

B21t—9 to 15 inches, brown (10YR 5/3) heavy silt loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, slightly sticky and plastic; few coarse roots and many fine roots; common fine pores; many moderately thick clay films on ped faces; noncalcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

B22t—15 to 21 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; few coarse roots and few medium roots; few medium and fine pores; many moderately thick clay films on ped faces; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.

B3ca—21 to 29 inches, very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) when moist; weak, medium, subangular blocky structure; extremely hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few fine pores; few thin clay films on ped faces; occasional patches of organic staining on ped faces; strongly calcareous; very strongly alkaline (pH 9.2); abrupt, smooth boundary.

C1ca—29 to 43 inches, light-gray (10YR 7/2) light silty clay loam, brown (10YR 5/3) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; very strongly alkaline (pH 9.3); clear, wavy boundary.

C2—43 to 60 inches, white (10YR 8/2) silty clay loam, light gray (2.5Y 7/1) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 20 to 35 inches. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma ranges from 1 to 3. Texture is silt loam or heavy silt loam. Reaction is mildly alkaline to strongly alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness of the A1 horizon ranges from 6 to 15 inches.

In the B2t horizon, value is 5 or 6 when the soils are dry and ranges from 2 to 5 when they are moist; chroma is 2 or 3. Texture is silty clay loam or heavy silt loam, and the content of clay ranges from 24 to 32 percent. Reaction is moderately alkaline to very strongly alkaline, and the horizon is noncalcareous to strongly calcareous. Thickness ranges from 5 to 21 inches.

In the B2tca or B3ca horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma ranges from 1 to 4. Texture is silt loam or silty clay loam. In the Cca and C horizons, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; and chroma is 1 to 3. Texture is silty clay loam, silt loam, very fine sandy loam, or fine sandy loam. Reaction is strongly alkaline or very strongly alkaline. Depth to the water table ranges from 30 to 50 inches where the soils are not drained.

Fridlo silt loam (Fu).—This soil is on lake terraces and alluvial fans along Blue Creek and the Malad River. A profile of this soil is the one described as representative for the Fridlo series Slopes are 0 to 3 percent. Because of the salt content, the water available to plants is only about 6 to 8 inches to a depth of 5 feet. If the soil is reclaimed, however, the available water holding capacity is 8 to 11 inches to that depth. Permeability is slow, and the rate of water intake is slow. Runoff is slow, and the hazard of erosion is slight. This soil is slightly to moderately affected by salts and moderately to strongly affected by alkali.

Included with this soil in mapping are small areas of Kearns silt loam, 1 to 3 percent slopes, and Lasil silt loam.

This Fridlo soil is used for irrigated alfalfa, small grains, corn for silage, sugar beets, and irrigated pasture. It also is used for nonirrigated small grains and alfalfa. Capability unit IVw–28, irrigated; Alkali Bottom range site.

Fridlo silt loam, moderately alkali (Fv).—This soil is on lake terraces in the lower part of the Bear River valley. It is similar to the soil that has the profile described as representative for the Fridlo series, but its slopes are 0 to 1 percent (fig. 4). In addition, the main part of the subsoil is heavy silt loam or light silty clay loam, and the subsoil and substratum contain less exchangeable sodium. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. Permeability is moderately slow, and the rate of water intake is moderate. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation is 13 to 14 inches, and the frost-free period is 140 to 159 days. This soil is slightly to moderately affected by alkali.

Included with this soil in mapping are small areas of Lasil silt loam, moderately alkali; Lasil silt loam; Airport silt loam; Warm Springs fine sandy loam; and Lewiston fine sandy loam.

This Fridlo soil is used mainly for irrigated alfalfa, corn for silage, sugar beets, tomatoes, small grains, and irrigated pasture. Some areas are used for nonirrigated small grains and alfalfa. Capability unit IIIw–28, irrigated; Alkali Bottom range site.

Gemson Series

The Gemson series consists of well-drained soils. These soils are on foothill slopes in the northern part of Hansel Valley. They formed in alluvium and colluvium derived mainly from basalt rocks but partly from limestone and sandstone. Slopes range from 6 to 20 percent. The vegetation in noncultivated areas is dominantly bluebunch wheatgrass as well as some Sandberg bluegrass, big sagebrush, yellowbrush, balsamroot, and annuals. Mean annual air temperature ranges from 46° to 50° F. Average annual precipitation ranges from 14 to 17 inches,

and the frost-free period is 110 to 130 days. Elevations range from 5,150 to 5,600 feet.

In a representative profile, the surface layer is grayish-brown silty clay loam about 8 inches thick. The subsoil is brown and pale-brown silty clay and silty clay loam that extends to a depth of 64 inches. The substratum, to a depth of 74 inches, is white silty clay loam. The surface layer and subsoil are mildly alkaline to strongly alkaline. The surface layer and the upper part of the subsoil are generally noncalcareous, and the lower part of the subsoil is moderately calcareous. The substratum is very strongly alkaline and very strongly calcareous.

Permeability is slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 14 inches before moisture is depleted. Roots penetrate to a depth of 60 inches.

These soils are used for range and nonirrigated crops.

Representative profile of Gemson silty clay loam, 10 to 20 percent slopes, in a cultivated field, 1,600 feet west and 100 feet south of the east quarter corner of section 16, T. 13 N., R. 6 W.

Ap1—0 to 4 inches, grayish-brown (10YR 5/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few medium pores; slightly calcareous; mildly alkaline (pH 7.8); clear, smooth boundary.

Ap2—4 to 8 inches, grayish-brown (10YR 5/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine roots; few very fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

B21t—8 to 12 inches, brown (10YR 5/3) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine pores; common thin clay films on ped faces; mildly alkaline (pH 7.9); clear, smooth boundary.

B22t—12 to 16 inches, brown (10YR 5/3) silty clay, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common very fine pores; common thin clay films on ped faces; slightly calcareous, lime is veined; mildly alkaline (pH 7.8); clear, wavy boundary.

B23t—16 to 21 inches, brown (10YR 5/3) heavy clay loam; brown (10YR 4/3) when moist; strong, coarse, prismatic structure that parts to moderate, medium and coarse, subangular blocky; very hard, very firm, sticky and plastic; common fine and very fine pores; many moderately thick clay films on ped faces; moderately calcareous, lime is veined; moderately alkaline (pH 8.2); gradual, wavy boundary.

B24tca—21 to 51 inches, pale-brown (10YR 6/3) silty clay loam; brown (10YR 4/3) when moist; strong, medium, prismatic structure that parts to moderate, medium and coarse, subangular blocky; very hard, firm, sticky and plastic; few very fine roots; few very fine pores; common thin clay films on ped faces; moderately calcareous; lime is veined, the soil matrix is noncalcareous, moderately alkaline (pH 8.4); gradual, irregular boundary.

B3tca—51 to 64 inches, pale-brown (10YR 6/3) silty clay loam, brown (7.5YR 4/3) when moist; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

Cca—64 to 74 inches, white (10YR 8/2) silty clay loam, very pale brown (10YR 8/3) when moist; massive; firm, slightly sticky and slightly plastic; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

A few fine pebbles, ¼ to ¾ inch in diameter, are on the surface and throughout the profile, and a few stones of basalt are on the surface. The soils are usually moist but in most years are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. The A1 horizon is silty clay loam or heavy silt loam. It is neutral to moderately alkaline and ranges from 6 to 8 inches in thickness.

In the B2t horizon, hue is 7.5YR or 10YR; value is 5 or 6 when the soils are dry and 2 to 4 when they are moist; values of 6 dry and 4 moist occur below depths of 12 to 16 inches; and chroma ranges from 2 to 4. The B2t horizon is mainly silty clay or silty clay loam but may be clay or heavy clay loam. Content of clay ranges from 35 to 45 percent, and clay films range from common to continuous and thin to thick on ped faces. Reaction is mildly alkaline to strongly alkaline. The horizon of carbonate accumulation begins in the lower part of the B2t horizon. The lime is in veins, but the soil matrix is noncalcareous in the B2t horizon.

In the Cca horizon, hue is 10YR or 7.5YR; value ranges from 5 to 8 when the soils are dry and from 4 to 8 when they are moist; and chroma ranges from 2 to 4. The Cca horizon is

Figure **4.—Profile of Fridlo silt loam, moderately alkali.**

silty clay loam or silty clay. Reaction is moderately alkaline to very strongly alkaline.

Gemson silty clay loam, 6 to 10 percent slopes (GcD).—This soil in on foothill slopes in northern Hansel Valley. Slopes are medium in length and slightly concave. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Gemson silty clay loam, 10 to 20 percent slopes; Parleys silt loam, 6 to 10 percent slopes; and Snowville gravelly silt loam, 6 to 20 percent slopes.

This soil is used mainly for range, and it also is used for nonirrigated small grain. If the soil were not closely intermingled with Rock land, more areas of it would be used for nonirrigated crops. Capability unit IIIe-U, nonirrigated; Upland Loam range site.

Gemson silty clay loam, 10 to 20 percent slopes (GcE).—This soil is on northwest- and northeast-facing foothill slopes in the northern part of Hansel Valley. Slopes are medium in length and slightly concave. A profile of this soil is the one described as representative for the series. Runoff is rapid, and the hazard of erosion is high. Moderate rill erosion is common, and shallow gullies have been formed in places.

Included with this soil in mapping are small areas of Gemson silty clay loam, 6 to 10 percent slopes; Parleys silt loam, 10 to 20 percent slopes; and Snowville gravelly silt loam, 6 to 20 percent slopes.

This soil is used for range and nonirrigated crops. If the soil were not closely intermingled with Rock land, more areas of it would be used for nonirrigated crops. Capability unit IVe-U, nonirrigated; Upland Loam range site.

Gemson-Rock land association, moderately steep (GEE).—This mapping unit is on foothills in the northern part of Hansel Valley. Slopes are medium in length. The association consists of about 50 percent Gemson silty clay loam, 10 to 20 percent slopes; 20 percent Middle cobbly silt loam, 10 to 30 percent slopes; and 20 percent Rock land. Included with these soils in mapping are areas of Parleys silt loam, 10 to 20 percent slopes, and Snowville gravelly silt loam, 6 to 20 percent slopes. These included soils make up about 10 percent of the total acreage.

These soils and Rock land are intermingled. The Gemson soil is in slightly concave areas that are under a cover of bluebunch wheatgrass and some Sandberg bluegrass and yellowbrush. The Middle soil is on ridges and supports bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and annuals. Rock land is on knobs and ridges and supports a good stand of bluebunch wheatgrass between the large stones of basalt.

Runoff is rapid, and the hazard of erosion is high.

This association is used for range. The Gemson soil is in capability unit IVe-U, nonirrigated; Upland Loam range site. The Middle soil is in capability unit VIe-U, nonirrigated; Upland Loam range site. Rock land is in capability unit VIIIs-X, nonirrigated; range site not assigned.

Gooch Series

The Gooch series consists of poorly drained soils. These soils are on broad lake plains and low lake terraces at the lower elevations in Bear River valley and Howell Valley. They formed in mixed lake sediments. Slopes are 0 to 1 percent. Vegetation consists of saltgrass, alkali sacaton, foxtail, and greasewood. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation ranges from 12 to 16 inches, and the frost-free period is 110 to 150 days. Elevations range from 4,220 to 4,500 feet.

In a representative profile, the surface layer is about 9 inches thick. It is light brownish-gray silt loam in the upper part and light brownish-gray loam in the lower part. The underlying layer extends to a depth of 60 inches or more. It is light-gray loam and light brownish-gray silt loam in the upper part, and it is white silty clay loam and light olive-gray fine sandy loam in the lower part. These soils are strongly alkaline to very strongly alkaline throughout. Lime has accumulated at the bottom of the surface layer or immediately below it. The surface layer is slightly calcareous, but the underlying layer is moderately or strongly calcareous.

Permeability is slow, and the rate of water intake is moderate. The water-holding capacity is 10 to 12 inches to a depth of 5 feet, but the water-supplying capacity for plant growth is only about 6 to 8 inches because of the high salt content. Roots penetrate to the water table, which is at a depth of less than 20 inches, but if the soils are drained, the roots extend to a depth of 60 inches.

These soils are used mainly for range, and some areas are used for improved pastures.

Representative profile of Gooch silt loam, in pasture, 1,500 feet south and 700 feet west of the northeast corner of section 22, T. 9 N., R. 2 W., about 2 miles west of Brigham City:

A11—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; few fine pores; slightly calcareous; very strongly alkaline (pH 9.6); abrupt, smooth boundary.

A12—3 to 9 inches, light brownish-gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; few fine pores; slightly calcareous; very strongly alkaline (pH 9.6); abrupt, smooth boundary.

C1ca—9 to 18 inches, light-gray (10YR 7/2) loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; common fine pores; many, large, distinct, light olive-brown (2.5Y 5/6) mottles; strongly calcareous; strongly alkaline (pH 9.0); abrupt, smooth boundary.

C2cag—18 to 30 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish-brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; common fine pores; many, large, distinct, light olive-brown (2.5Y 5/6) mottles; strongly calcareous; strongly alkaline (pH 9.0); abrupt, smooth boundary.

IIC3cag—30 to 48 inches, white (N 8/0) silty clay loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; very few fine roots; few fine and medium pores; many, large, distinct, olive-yellow (2.5Y 6/6) mottles; strongly calcareous; strongly alkaline (pH 8.8); abrupt, smooth boundary.

IIIC4g—48 to 56 inches, light olive-gray (5Y 6/2) fine sandy loam, gray (5Y 5/1) when moist; massive; soft, very friable, nonsticky and nonplastic; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles; moderately calcareous; strongly alkaline (pH 8.8); abrupt, smooth boundary.

IVC5g—56 to 65 inches, white (N 8/0) silty clay loam, gray (2.5Y 5/1) when moist; massive; hard, firm, very sticky and slightly plastic; many, large, distinct, light olive-brown (2.5Y 5/4) mottles; strongly calcareous; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation ranges from 9 to 14 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 25 to 27 percent. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer unless they are irrigated.

In the A1 horizon, hue is 10YR or 2.5Y, value is 3 or 4 when the soils are moist, and chroma is 1 or 2. The horizon is slightly calcareous to strongly calcareous. It ranges from 4 to 9 inches in thickness.

In the Cca, Ccag, Cg, and C horizons, hue is 10YR to 5Y or neutral; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 0 to 2. These horizons are silty clay, silt loam, loam, or fine sandy loam. Structure is weak to moderate, subangular blocky in the upper part, but the lower part is structureless (massive). These soils are moderately to strongly affected by salts and alkali. Depth to the water table is generally less than 20 inches.

Gooch silt loam (Gh).—This soil is on low lake terraces and lake plains. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Warm Springs fine sandy loam, Roshe Springs silt loam, and Cudahy silt loam.

This Gooch soil is used mainly for range. Some areas of it are flood-irrigated and are used for improved pasture. Capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Goring Series

The Goring series consists of well-drained soils. These soils are on mountain slopes and alluvial fans near Mantua. They formed in colluvium and alluvium derived from quartzite and sandstone. Slopes range from 10 to 40 percent. Vegetation consists of slender wheatgrass, Great Basin wildrye, native bluegrass, and big sagebrush. Mean annual air temperature ranges from 41° to 44° F. Average annual precipitation ranges from 20 to 25 inches, and the frost-free period is 80 to 100 days. Elevations range from 5,200 to 7,000 feet.

In a representative profile, the surface layer is dark grayish-brown light clay loam about 7 inches thick. The subsoil is dark grayish-brown clay loam in the upper 11 inches, brown and yellowish-red clay and gravelly clay in the next 30 inches, and yellowish-red gravelly clay to a depth of 60 inches or more. The entire profile is slightly acid.

Permeability is slow, and the rate of water intake is slow. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is 16 to 18 inches before moisture is depleted. Roots extend to a depth of more than 60 inches.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Goring clay loam, 10 to 25 percent slopes, in an area of Goring-Yeates Hollow association, moderately steep, in range, 1,000 feet west and 600 feet north of the south quarter corner of section 9, T. 9 N., R. 1 W., north of Mantua:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; slightly acid (pH 6.4); clear, smooth boundary.

B1—7 to 18 inches, dark grayish-brown (10YR 4/2) heavy clay loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, subangular blocky structure; very hard, firm, sticky and very plastic; few fine, medium, and large roots; few fine and medium pores; few thin clay films on ped faces and in pores; slightly acid (pH 6.4); gradual, smooth boundary.

B21t—18 to 28 inches, brown (7.5YR 5/3) light clay, dark brown (7.5YR 3/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; extremely hard, very firm, very sticky and very plastic; few fine roots; many micro and very fine pores; many thin clay films on ped faces and in pores; slightly acid (pH 6.2); gradual, wavy boundary.

B22t—28 to 37 inches, brown (7.5YR 5/4) clay, brown (7.5YR 4/4) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; extremely hard, very firm, very sticky and very plastic; few fine roots; many very fine pores; continuous moderately thick clay films on ped faces; slightly acid (pH 6.2); diffuse, wavy boundary.

B23t—37 to 48 inches, yellowish-red (5YR 5/6) clay, brown (7.5YR 5/4) when moist; strong, coarse, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few very fine and fine pores; continuous thick clay films on ped faces; slightly acid (pH 6.2); gradual, irregular boundary.

B3—48 to 60 inches, yellowish-red (5YR 5/6) gravelly clay, brown (7.5YR 5/4) when moist; weak, coarse, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; many moderately thick clay films on ped faces; 25 percent gravel; slightly acid (pH 6.3).

The solum ranges from 48 inches to more than 60 inches in thickness. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, hue is 10YR or 7.5YR; value is 2 or 3 when the soils are moist; and chroma is 2 or 3. The A1 horizon is generally clay loam but may be loam. Reaction is medium acid or slightly acid. The A1 horizon ranges from 7 to 15 inches in thickness.

In the B1 horizon, hue is 10YR or 7.5YR. The horizon ranges from 0 to 11 inches in thickness. In the B2t and B3 horizons, hue is 7.5YR or 5YR; value is 4 or 5 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma ranges from 3 to 6. The upper B2t horizon has a value of 3 and a chroma of 3. Texture of the B2t horizon is clay or silty clay. Structure is weak, medium and coarse, prismatic. Clay films range from many to continuous and from thin to thick on ped faces. Reaction of the B2t and B3 horizons is medium acid or slightly acid. The B2t horizon ranges from 30 to 33 inches in thickness. In the B3 horizon, content of coarse fragments ranges from 25 to 50 percent. The fragments are gravel and cobblestones.

Goring-Yeates Hollow association, moderately steep (GLE).—This mapping unit is on the mountains north of Mantua. It consists of about 60 percent Goring clay loam, 10 to 25 percent slopes, and 30 percent Yeates Hollow stony loam, 10 to 25 percent slopes. Included with these soils in mapping are areas of Obray clay, 10 to 25 percent slopes; Goring clay loam, 25 to 40 percent slopes; and Yeates Hollow stony loam, 25 to 40 percent slopes. These included soils make up about 10 percent of the total acreage.

The Goring and Yeates Hollow soils generally are on south- and west-facing mountain slopes and alluvial fans, but in places there are short slopes that are north and east facing. Both soils occur on all aspects. The vegetation consists of mulesear dock, bluebunch wheatgrass, slender

wheatgrass, bluegrass, Great Basin wildrye, and big sagebrush.

A profile of the Goring soil in this association is the one described as representative for the Goring series. The Yeates Hollow soil has a profile similar to the one described for that series, but the surface layer is stony loam.

Runoff is medium on these soils, and the hazard of erosion is moderate. The water-supplying capacity is 10 to 11 inches for plant growth before moisture is depleted.

The soils of this association are used for range, wildlife habitat, and water supply. The Goring soil is in capability unit VIe-M, nonirrigated; Mountain Loam range site. The Yeates Hollow soil is in capability unit VIs-M, nonirrigated; Mountain Stony Loam range site.

Goring Series, Brown Subsoil Variant

The Goring series, brown subsoil variant, consists of well-drained soils. These soils are on small plains in mountain valleys southeast of Mantua. They formed in mixed alluvium and valley fill derived from many kinds of parent rocks. Slopes are from 0 to 1 percent. Vegetation consists of bluegrass, bearded wheatgrass, Great Basin wildrye, and some big sagebrush. Mean annual air temperature ranges from 40° to 42° F. Average annual precipitation ranges from 22 to 26 inches, and the frost-free period is 75 to 90 days. Elevation is about 6,600 feet.

In a representative profile, the surface layer is dark-gray loam about 21 inches thick, and the subsurface layer is light brownish-gray loam about 1 inch thick. The subsoil is light yellowish-brown and pale-brown silty clay in the upper 32 inches and is light-gray clay loam in the lower 7 inches. Between depths of 61 and 68 inches is light-gray loam. The surface layer is slightly acid or neutral. The subsurface layer, subsoil, and substratum are neutral. The subsoil and substratum contain many small concentrations of manganese.

Permeability is slow, and the rate of water intake is slow. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is 17 to 22 inches for plant growth before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

Goring soils, brown subsoil variant, are used for range, wildlife habitat, and water supply. In the past, native hay was cut from some areas of these soils.

Representative profile of Goring loam, brown subsoil variant, in range, 1,300 feet west of the east quarter corner of section 1, T. 8 N., R. 1 W. about 5 miles southeast of Mantua:

A11—0 to 7 inches, dark-gray (10YR 4/1) heavy loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure; very hard, friable, slightly sticky and plastic; common very fine and medium roots; few very fine pores; neutral (pH 6.6); gradual, smooth boundary.

A12—7 to 21 inches, dark-gray (10YR 4/1) light clay loam, very dark brown (10YR 2/2) when moist; very hard, friable, sticky and plastic; common very fine and medium roots; few very fine pores; slightly acid (pH 6.2); gradual, wavy boundary.

A2—21 to 22 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine pores; neutral (pH 6.6); gradual, wavy boundary.

B21t—22 to 31 inches, light yellowish-brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) when moist; moderate, medium, prismatic structure that parts to strong, medium, angular and subangular blocky; extremely hard, firm, sticky and very plastic; few fine and very fine roots; many very fine pores; thin continuous clay films on ped faces and in pores; neutral (pH 7.0); gradual, wavy boundary.

B22t—31 to 54 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 5/3) when moist; weak, medium, prismatic structure that parts to strong, medium, angular and subangular blocky; extremely hard, firm, sticky and very plastic; many very fine pores; thin continuous clay films on ped faces and in pores; neutral (pH 7.0); clear, wavy boundary.

B3—54 to 61 inches, light-gray (2.5Y 7/2) light clay loam, brown (10YR 4/3) when moist; strong, medium and coarse, angular blocky structure; very hard, friable, slightly sticky and slightly plastic; many very fine pores; common thin clay films on ped faces; neutral (pH 7.2); abrupt, smooth boundary.

C—61 to 68 inches, light-gray (2.5Y 7/2) heavy loam, dark yellowish brown (10YR 4/4) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, friable, slightly sticky and slightly plastic; neutral (pH 7.2).

In the foregoing profile, many small manganese shot, 1 millimeter or less in diameter, are between depths of 20 and 60 inches or more.

The solum ranges from 48 to 61 inches in thickness. The soils are usually moist, but between depths of 4 and 12 inches, they are dry for 60 to 90 consecutive days in summer in most years.

In the A1 horizon, chroma is 1 or 2. Texture is loam at the surface and light clay loam at the bottom of the A1 horizon. Reaction is slightly acid or neutral in this horizon and thickness ranges from 20 to 24 inches. The A2 horizon is not continuous and is 0 to 4 inches thick. In the B2t horizon, chroma is 3 or 4. Structure is moderate to weak, medium, prismatic. Thickness of the B2t horizon ranges from 28 to 36 inches. In the B3 horizon, hue is 10YR to 2.5Y and chroma is 2 or 3.

Goring loam, brown subsoil variant (GM).—This soil is on small mountain valley plains. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Obray clay, 10 to 25 percent slopes.

This Goring variant is now used for range, wildlife habitat, and water supply. Part of the acreage yielded native hay in the past. Capability unit VIe–M, nonirrigated; Mountain Loam range site.

Gravel Pits

Gravel pits (Gp) is a miscellaneous land type that occurs at scattered locations in the survey area. These pits are open excavations from which gravel, sand, and cobblestones have been removed. Most of the material has been used in building construction, for road grades and surfacing, and for railroad grades. Some of the pits are used as a commercial source of high-quality sand and gravel for making concrete. Most of the pits are on steep terrace escarpments or off-shore bars that were associated with prehistoric Lake Bonneville. Gravel pits have no value for crops or grazing, but some are valuable for industrial use. Capability unit VIIIs-4, nonirrigated; range site not assigned.

Greenson Series

The Greenson series consists of somewhat poorly drained soils. These soils are on broad, low lake terraces and lake plains in the Bear River valley south and west of Tremonton. They formed in fine textured and moderately fine textured, mixed lake sediments derived dominantly

from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is mainly saltgrass, alkali sacaton, greasewood, alkali bluegrass, and some foxtail and sedges. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 135 to 145 days. Elevations range from 4,250 to 4,325 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 12 inches thick. The subsoil is pale-brown heavy silt loam about 7 inches thick. The substratum is very pale brown and light-gray silt loam, about 20 inches thick, over stratified, pink silty clay and light-gray fine sandy loam that extends to a depth of 60 inches or more. The surface layer and subsoil are moderately alkaline and slightly calcareous. A layer of strong lime accumulation is at a depth of 19 inches. The substratum is strongly calcareous and very strongly alkaline.

Roots penetrate easily to a depth of about 40 inches and can extend to a depth of more than 60 inches. Permeability is moderate above the silty clay substratum but is slow in the silty clay.

Greenson soils are used for irrigated crops and native pasture.

Representative profile of Greenson silt loam, clay substratum, in a cultivated field, 700 feet south and 950 feet west of the northeast corner of section 33, T. 11 N., R. 3 W., about 5 miles southwest of Tremonton:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, very friable, slightly sticky and slightly plastic; slightly calcareous; moderately alkaline (pH 8.0); clear, smooth boundary.

A1—6 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; common fine and medium pores; slightly calcareous; moderately alkaline (pH 8.0); abrupt, smooth boundary.

B2—12 to 19 inches, pale-brown (10YR 6/3) heavy silt loam, dark grayish brown (10YR 4/2) when moist; moderate, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common very fine tubular pores; numerous worm casts; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.

C1ca—19 to 27 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; weak, medium and coarse, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); clear, smooth boundary.

C2ca—27 to 30 inches, light-gray (2.5Y 7/2) heavy silt loam, pale olive (5Y 6/3) when moist; common, fine, distinct, strong-brown (7.5Y 5/6) mottles; weak, medium and coarse, subangular blocky structure; very hard, friable, slightly sticky and plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); abrupt, smooth boundary.

C3ca—30 to 39 inches, very pale brown (10YR 7/3) light loam, pale brown (10YR 6/3) when moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); clear, smooth boundary.

C4—39 to 51 inches, pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) when moist; few, fine, faint, strong-brown (7.5YR 5/6) mottles; massive; extremely hard, very firm, sticky and very plastic; common very fine pores; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); clear, smooth boundary.

C5—51 to 54 inches, light-gray (2.5Y 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; soft, very friable; strongly calcareous; very strongly alkaline (pH 9.1); clear, smooth boundary.

C6—54 to 64 inches, pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) when moist; few, medium, faint, yellowish-brown (10YR 5/4) mottles; massive; extremely hard, very firm, sticky and very plastic; common very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 16 to 19 inches. Between depths of 10 and 40 inches, the texture averages silt loam, and the content of clay ranges from 18 to 22 percent. The soils are usually moist, and in most years they are not dry in all parts between depths of 4 and 12 inches for as much as 60 consecutive days in the summer.

In the A1 horizon, texture is silt loam or loam. The A1 horizon is slightly to moderately calcareous, and ranges from 7 to 13 inches in thickness. In the B2 horizon, chroma is 2 or 3. Reaction is moderately alkaline to very strongly alkaline. The B2 horizon is slightly to strongly calcareous and ranges from 3 to 7 inches in thickness.

In the Cca and C horizons, hue ranges from 7.5YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; an chroma ranges from 1 to 4. The C horizons are silty clay or silty clay loam and have layers, 1/16 to 3 inches thick, of very fine sandy loam or fine sandy loam. The Cca and C horizons are strongly calcareous to very strongly calcareous, and reaction is strongly alkaline or very strongly alkaline. Most areas have been drained, and depth to the water table is 48 to 60 inches or more, but where the soils are not drained, the water table is at a depth of 30 to 48 inches. Distinct or faint mottles are at a depth of 26 to 36 inches and range from few to many and fine to medium.

Greenson silt loam, clay substratum (Gr).—This soil is on broad, low lake terraces and lake plains in the Bear River valley south and west of Tremonton. A profile of this soil is the one described as representative for the Greenson series. Slopes are 0 to 1 percent. The rate of water intake is moderate. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 10 to 12 inches to a depth of 5 feet.

Included with this soil in mapping are small areas of Collett silty clay loam; Fielding silt loam, warm; Greenson silt loam, strongly alkali; and Honeyville silt clay loam.

This soil is used for irrigated tomatoes, sugar beets, alfalfa, small grains, irrigated pasture, and corn for silage. Capability unit IIIw-25, irrigated; range site not assigned.

Greenson silt loam, strongly alkali (Gs).—This soil is on low lake terraces and lake plains about 3 miles southwest of Tremonton. Slopes are 0 to 1 percent. The surface is very uneven where the soil has not been leveled. The rate of water intake is slow. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is about 10 to 12 inches to a depth of 5 feet, but the water available to plants is about 3 to 8 inches because of the high salt content. This soil is moderately to strongly affected by salts and alkali.

Included with this soil in mapping are small areas of Collett silty clay loam and Greenson silt loam, clay substratum.

This soil is used for irrigated alfalfa, sugar beets, small grains, corn for silage, and unimproved pasture. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Gullied Land

Gullied land (GU) is a miscellaneous land type that occurs on lake terraces and foothills in the western part of the survey area. It is characterized by an intricate network of gullies, some blowout areas, and few soil dunes. Gullied land is in areas of very silty soils that formed in mixed lake sediments and in loamy sand residuum on steep foothills. The gullies range from about 1 to 10 feet in depth. Gully banks, unprotected by vegetation, have been subjected to soil blowing and water erosion, and areas as large as 5 to 10 acres have been denuded of the original surface layer and, in some places, some of the subsoil. The small dunes are from 1 to 6 feet high and have a surface layer of silt loam or fine sandy loam. The vegetation consists of juniper, thorny hopsage, Indian ricegrass, and snakeweed in the foothills and greasewood, shadscale, big sagebrush, and squirreltail on the lake terraces. In the foothills, outcrops of rock are common.

Gullied land has some value for wildlife habitat. Capability unit VIIIe-E, nonirrigated; range site not assigned.

Hansel Series

The Hansel series consists of well-drained soils on lake terraces. These soils formed in mixed lake sediments derived from limestone, sandstone, and quartzite. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of big sagebrush and bunchgrasses. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,400 to 5,000 feet.

In a representative profile (fig. 5), the surface layer is light brownish-gray silt loam about 10 inches thick. The subsoil is light-gray silty clay loam about 8 inches thick. The substratum, extending to a depth of 60 inches or more, is white and light-gray silty clay loam. The surface layer and subsoil are moderately alkaline and noncalcareous. The substratum is strongly alkaline to very strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 9 to 10.5 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most are between depths of 20 and 30 inches.

These soils are used mainly for nonirrigated crops. Some areas are used for irrigated crops and wildlife habitat.

Representative profile of Hansel silt loam, 1 to 6 percent slopes, in a cultivated field, 800 feet north and 750 feet west of the east quarter corner of section 30, T. 13 N., R. 5 W., about 2¾ miles north and ½ mile west of Howell Post Office:

A11—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common fine and medium pores; moderately alkaline (pH 8.2); clear, smooth boundary.

A12—6 to 10 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common fine and medium pores; moderately alkaline (pH 8.2); clear, smooth boundary.

Figure 5.—**Profile of Hansel silt loam, 1 to 6 percent slopes.**

B21t—10 to 14 inches, light-gray (10YR 7/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure; slightly hard, firm, sticky and plastic; few very fine roots; common very fine pores; common thin clay films on ped faces; moderately alkaline (pH 8.2); clear, smooth boundary.

B22t—14 to 18 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common medium pores; few thin clay films on ped faces; moderately alkaline (pH 8.4); gradual, wavy boundary.

C1ca—18 to 23 inches, white (10YR 8/2) light silty clay loam, pale brown (10YR 6/3) when moist; moderate, fine and medium, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine roots; common medium pores; strongly calcareous; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2ca—23 to 33 inches, white (10YR 8/2) light silty clay loam, light brownish gray (2.5YR 6/2) when moist; weak, fine and medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common medium pores; strongly calcareous, lime is nonindurated and disseminated; very strongly alkaline (pH 9.2); gradual, smooth boundary.

C3—33 to 45 inches, light-gray (2.5YR 7/2) silty clay loam, brown (10YR 5/3) when moist; massive; hard, firm, slightly sticky and slightly plastic; common medium pores; strongly calcareous, lime is nonindurated and veined; very strongly alkaline (pH 9.4); gradual, smooth boundary.

C4—45 to 62 inches, light-gray (2.5YR 7/2) silty clay loam, brown (10YR 5/3) when moist; massive; hard, firm, sticky and plastic; strongly calcareous, lime is nonindurated and veined; very strongly alkaline (pH 9.6).

These soils are usually dry at all depths between 4 and 12 inches. Depth to the horizon of carbonate accumulation ranges from 10 to 22 inches. In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is mainly silt loam, but in places it is loam or heavy silt loam. The A1 horizon ranges from 4 to 15 inches in thickness, is mildly alkaline to strongly alkaline, and is noncalcareous or slightly calcareous.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma ranges from 2 to 4. This horizon is silty clay loam or heavy silt loam and ranges from 7 to 17 inches in thickness. Content of clay is dominantly 28 to 32 percent. Clay films are thin and range from few to common on ped faces. This horizon is neutral to strongly alkaline and noncalcareous to moderately calcareous.

The Cca horizon in most places begins at the lower boundary of the B2t horizon. The Cca and C horizons have a hue of 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma ranges from 2 to 4. These horizons are silty clay loam or silt loam. They are strongly alkaline or very strongly alkaline.

Hansel silt loam, 0 to 1 percent slopes (HaA).—This soil is on lake terraces. Slopes are medium to long. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Hansel silt loam, 1 to 6 percent slopes, and Thiokol silt loam, 0 to 1 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife habitat, and a small area is used for irrigated alfalfa, corn for silage, sugar beets, and small grains. Capability unit IIc–2, irrigated; capability unit IVc–U, nonirrigated; range site not assigned.

Hansel silt loam, 1 to 6 percent slopes (HaB).—This soil is on lake terraces. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the Hansel series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kearns silt loam, 3 to 6 percent slopes; Parleys silt loam, 1 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated crops. Some areas are used for wildlife habitat. Capability unit IVe–UZ, nonirrigated; range site not assigned.

Hansel silt loam, 6 to 10 percent slopes (HaD).—This soil is generally on north- and east-facing slopes and is on lake terraces. Slopes are short to medium in length and are slightly convex. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Parleys silt loam, 6 to 10 percent slopes; and Pomat silt loam, 6 to 10 percent slopes.

This soil is used mainly for nonirrigated crops. Some areas are used for wildlife habitat. Capability unit IVe–UZ, nonirrigated; range site not assigned.

Harding Series

The Harding series consists of well-drained soils that are affected by alkali. These soils are in slightly depressed areas on lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation consists of greasewood, shadscale, annual mustard, foxtail, cheatgrass, and annual weeds. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,230 to 4, 500 feet.

In a representative profile, the surface layer is very pale brown silt loam about 5 inches thick. The subsoil is very pale brown silty clay about 14 inches thick. The substratum, extending to a depth of 60 inches is light-gray and pale-yellow silt loam and very fine sandy loam. The soils are strongly calcareous or moderately calcareous throughout and strongly alkaline to very strongly alkaline.

Permeability is slow above a depth of 19 inches but is moderate below that depth. The rate of water intake is slow. The water holding capacity is 10 to 12 inches to a depth of 5 feet, but the water available to plants is only about 3 to 6 inches because of the high salt content. Roots penetrate to depths below 60 inches, but most are less than 25 inches deep.

These soils are used for range and, to a limited extent, for wildlife habitat.

Representative profile of Harding silt loam, in range, 1,500 feet north and 1,200 feet east of the southwest corner of section 1, T. 9 N., R. 8 W., about 9 miles southwest of Golden Spike National Monument:

A11—0 to 2 inches, very pale brown (10 YR 7/3) silt loam, olive brown (2.5YR 4/3) when moist; weak, medium, platy structure; slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, smooth boundary.

A12—2 to 5 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, thin, platy structure; soft, friable, sticky and slightly plastic; common very fine and fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.9); clear, smooth boundary.

B2t—5 to 12 inches, very pale brown (10YR 7/3) silty clay, yellowish brown (10YR 5/4) crushed, and brown (10YR 4/3) aggregate when moist; moderate, fine and medium, columnar structure; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; many very fine interstitial pores; continuous moderately thick clay films on ped faces; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); clear, smooth boundary.

B3tca—12 to 19 inches, very pale brown (10YR 7/3) silty clay, yellowish brown (10YR 5/4) when moist; weak, fine and medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C1ca—19 to 25 inches, light-gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) when moist; weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, smooth boundary.

C2ca—25 to 42 inches, light-gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very

fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); diffuse, wavy boundary.

C3—42 to 57 inches, light-gray (2.5Y 7/2) very fine sandy loam, light olive brown (2.5Y 5/4) when moist; few, fine, faint, light yellowish-brown (2.5Y 6/4) mottles; massive; soft, friable, nonsticky and nonplastic; moderately calcareous; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C4—57 to 64 inches, pale-yellow (5Y 7/3) silt loam, olive (5Y 5/3) when moist; few, fine, faint, light yellowish-brown (2.5Y 6/4) mottles; massive; soft, very friable, nonsticky and nonplastic; moderately calcareous; strongly alkaline (pH 8.6).

The solum ranges from 18 to 21 inches in thickness. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry. Structure is weak to moderate and very thin to medium platy. Reaction is strongly alkaline to very strongly alkaline. Thickness of the A1 horizon ranges from 4 to 5 inches.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma is 3 or 4. This horizon is silty clay or heavy silty clay loam; content of clay ranges from 37 to 50 percent. Clay films range from thin to moderately thick and from many to continuous.

The Cca horizon in most places begins as the lower part of the B2t horizon. Hue ranges from 10YR to 5Y; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma ranges from 2 to 4. This horizon is light silty clay loam, silt loam, or very fine sandy loam. Reaction is strongly alkaline to very strongly alkaline. Faint to distinct mottles are at depths of 25 to 45 inches. These soils are moderately to strongly affected by salts and alkali.

Harding silt loam (HD).—This soil is on lake terraces. Slopes are slightly concave and medium in length. Runoff is medium, and the hazard of erosion is moderate. In places many shallow to moderately deep gullies have been formed. Sheet erosion is common.

Included with this soil in mapping are small areas of Mellor silt loam, 1 to 6 percent slopes; Bram silt loam; and Palisade silt loam, 1 to 6 percent slopes.

This soil is used for range and, to a limited extent, for wildlife habitat. Capability unit VIIs-S8, nonirrigated; Semidesert Alkali Flats range site.

Hendricks Series

The Hendricks series consists of well-drained soils. These soils are on alluvial fans and foothill slopes in areas that are slightly above the highest lake terraces. They formed in alluvium and residuum derived mainly from sandstone and quartzite. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas consists mainly of bluebunch wheatgrass, slender wheatgrass, big sagebrush, balsamroot, yarrow, and annual grasses. Mean annual air temperature rages from 45° to 49° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 110 to 130 days. Elevations range from 5,150 to 5,600 feet.

In a representative profile, the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is dominantly brown silty clay loam that extends to a depth of 67 inches or more. These soils are noncalcareous, except in the lower part of the subsoil. The surface layer is neutral, and the subsoil is neutral to moderately alkaline.

Permeability is moderately slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 14 to 16 inches before moisture is depleted. Roots penetrate to a depth of 60 inches.

Hendricks soils are used for nonirrigated crops.

Representative profile of Hendricks silt loam, 10 to 20 percent slopes, in a cultivated field, 250 feet west and 550 feet south of east quarter corner of section 9, T. 14 N., R. 5 W., in Pocatello Valley:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure that parts to weak, medium, granular; soft, friable, nonsticky and slightly plastic; few fine roots; few fine interstitial pores; neutral (pH 7.1); abrupt, smooth boundary.

B1—6 to 11 inches, grayish-brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky; hard, firm, slightly sticky and plastic; few fine roots; common fine and a few medium interstitial pores; few thin clay films on ped faces; neutral (pH 7.3); gradual, wavy boundary.

B21t—11 to 21 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, slightly sticky and plastic; few very fine roots; few fine and medium interstitial pores; many moderately thick clay films on ped faces; mildly alkaline (pH 7.6); gradual, wavy boundary.

B22t—21 to 38 inches, light yellowish-brown (10YR 6/4) light silty clay loam, brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, slightly sticky and slightly plastic; few very fine roots; few medium interstitial pores; many thin clay films on ped faces; mildly alkaline (pH 7.6); gradual, wavy boundary.

B23t—38 to 56 inches, brown (10YR 5/3) light silty clay loam, dark brown (7.5YR 4/3) when moist; weak, coarse, subangular blocky structure that parts to weak, fine and medium, subangular blocky; very hard, firm, slightly sticky and slightly plastic; few very fine roots; few fine and common medium interstitial pores; many thin clay films on ped faces; mildly alkaline (pH 7.8); gradual, wavy boundary.

B24tca—56 to 67 inches, brown (7.5YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) when moist; moderate, fine and coarse, subangular blocky structure; very hard, firm, slightly sticky and plastic; few medium pores; many moderately thick clay films on ped faces; slightly calcareous, lime is veined; moderately alkaline (pH 8.0).

The solum ranges from 48 to 60 inches or more in thickness. Lime accumulation is at depths below 48 inches in places. The content of gravel is 5 to 10 percent throughout the profile in some places. The soils are usually moist, but they are dry in all parts between depths of 4 to 12 inches for more than 60 consecutive days in summer.

In the A horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is neutral or mildly alkaline and ranges from 6 to 12 inches in thickness.

The B1 horizon is 4 to 6 inches thick. In the B2t horizon, hue is 10YR or 7.5Y; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. This horizon is silty clay loam or clay loam. Structure is weak to moderate and prismatic or subangular blocky. Reaction is mildly alkaline to moderately alkaline. Clay films are thin to moderately thick and common to continuous on ped faces.

In the C horizon, hue is 10YR or 7.5Y; value is 5 or 6 when the soils are dry; and chroma is 3 or 4. This horizon is light silty clay loam or heavy loam.

Hendricks silt loam, 1 to 6 percent slopes (HeB).—This soil is on alluvial fans in Pocatello Valley and Whites Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the

Hendricks series, but the surface layer averages about 12 inches in thickness. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes; Parleys silt loam, 1 to 6 percent slopes; and Red Rock silt loam, high rainfall, 0 to 3 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIe–M, nonirrigated; range site not assigned.

Hendricks silt loam, 6 to 10 percent slopes (HeD).—This soil generally is on north- or east-facing slopes on alluvial fans in Pocatello Valley and Whites Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the Hendricks series, but the surface layer averages about 7 inches in thickness. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Forsgren silt loam, 6 to 10 percent slopes; Parleys silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe–M, nonirrigated; range site not assigned.

Hendricks silt loam, 10 to 20 percent slopes (HeE).—This soil is on generally north- or east-facing slopes, which are short to medium in length, and on alluvial fans and foothill slopes that are slightly above the highest lake terraces. A profile of this soil is the one described as representative for the Hendricks series. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common in some areas.

Included with this soil in mapping are small areas of Forsgren silt loam, 10 to 20 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; Parleys silt loam, 10 to 20 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IVe–M, nonirrigated; range site not assigned.

Hendricks complex, 6 to 10 percent slopes (HkD).—This complex is on medium-length foothill slopes and alluvial fans just above the highest lake terraces in Pocatello Valley. It consists of about 60 percent Hendricks silt loam, 6 to 10 percent slopes, and 30 percent Kearns silt loam, high lime variant, 6 to 10 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 6 to 10 percent slopes; Munk gravelly silt loam, 10 to 20 percent slopes; and Parleys silt loam, 6 to 10 percent slopes. These included soils make up about 10 percent of the total acreage.

The Hendricks soil is on slightly concave, north- and east-facing slopes of the drainageways and in the flat area between drainageways. The Kearns high lime variant is on slightly steeper slopes that extend into the drainageways and is on convex knolls. It is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Runoff is medium on these soils, and the hazard of erosion is moderate.

The soils of this complex are used for nonirrigated small grains. Capability unit IIIe–M, nonirrigated; range site not assigned.

Honeyville Series

The Honeyville series consists of moderately well drained soils. These soils are on broad, low lake terraces and lake plains in the Bear River valley south and west of Garland. They formed in calcareous, fine textured and moderately fine textured, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas consists of western wheatgrass, Great Basin wildrye, big sagebrush, and annual weeds. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 130 to 150 days. Elevations range from 4,260 to 4,355 feet.

In a representative profile, the surface layer is grayish-brown silty clay loam about 13 inches thick. The subsoil is brown and pale-brown silty clay loam about 19 inches thick. The substratum is pale-brown and pinkish-gray silty clay loam that extends to a depth of 64 inches. The surface layer is moderately calcareous and moderately alkaline to strongly alkaline; the subsoil is moderately calcareous and strongly alkaline; and the substratum is strongly calcareous and strongly alkaline to very strongly alkaline. A layer of strong lime accumulation is at a depth of 32 inches.

Permeability is slow, and the rate of water intake is moderate. Available water holding capacity is 10.5 to 12 inches to a depth of 5 feet. Roots are mainly above the water table, but where the soils are drained, roots penetrate to a depth of 48 inches or more.

Honeyville soils are used for irrigated crops.

Representative profile of Honeyville silty clay loam, in a cultivated area, 900 feet north and 1,800 feet west of the northeast corner of section 22, T. 11 N., R. 3 W., about 2 miles south of Tremonton:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; moderately calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

A1—8 to 13 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine, medium, and coarse pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.

B21—13 to 19 inches, brown (10YR 5/3) heavy silty clay loam, dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; few thin clay films on ped faces; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, smooth boundary.

B22—19 to 32 inches, pale-brown (10YR 6/3) heavy silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to weak, coarse, subangular blocky; very hard, very firm, very sticky and plastic; few fine and very fine roots; common fine pores and few medium pores; few thin clay films on ped faces; moderately calcareous; strongly alkaline (pH 8.5); clear, wavy boundary.

C1ca—32 to 40 inches, pale-brown (10YR 6/3) heavy silty clay loam, brown (10YR 5/3) when moist; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, very sticky and very plastic; few very fine roots; many fine and few medium pores; strongly calcareous, some lime veins; very strongly alkaline (pH 9.2); clear, wavy boundary.

C2ca—40 to 64 inches, pinkish-gray (7.5YR 6/2) heavy silty clay loam, brown (10YR 5/3) when moist; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; massive; very hard, very firm, sticky and very plastic; common very fine and few large pores; strongly calcareous, some laminar lime veins; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 19 to 36 inches. Between depths of 10 and 40 inches, the texture averages heavy silty clay loam and the content of clay ranges from 35 to 40 percent. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, chroma is 2 or 3. Texture is silty clay loam or heavy silty clay loam. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is slightly or moderately calcareous and ranges from 7 to 15 inches in thickness.

In the B2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture is heavy silty clay loam or light silty clay. Reaction is moderately alkaline to strongly alkaline. The B2 horizon is moderately to strongly calcareous.

In the Cca horizon, hue is 7.5YR or 10YR; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Mottles are at a depth below 30 inches and are few to common, fine to medium, and faint to prominent. This horizon is silty clay or silty clay loam. It is strongly alkaline to very strongly alkaline and moderately calcareous to strongly calcareous. Most of the acreage of these soils has been drained, and the depth to the water table is 44 inches to more than 60 inches. Where the soils are not drained, the water table is at a depth of 30 to 44 inches.

Honeyville silty clay loam (Ho).—This soil is on broad, low lake terraces and lake plains in Bear River Valley south and west of Garland. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. Most areas of this soil have been leveled and tile drained.

Included with this soil in mapping are small areas of Collett silty clay loam; Fielding silt loam, warm; and Greenson silt loam, clay substratum.

This soil is used for irrigated alfalfa, small grains, sugar beets, corn for silage, tomatoes, and irrigated pasture. Capability unit IIIw-25, irrigated; range site not assigned.

Hupp Series

The Hupp series consists of well-drained soils. These soils are on alluvial fans, mainly in the northern and central parts of the survey area. They formed in very gravelly and cobbly alluvium derived mainly from limestone, sandstone, and quartzite parent rocks. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas mainly consists of big sagebrush, yellowbrush, bluebunch wheatgrass, Sandberg bluegrass, cheatgrass, and annual weeds. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,300 to 5,300 feet.

In a representative profile (fig. 6), the surface layer is grayish-brown and brown gravelly silt loam about 18 inches thick. The subsoil is pale-brown very gravelly silt loam about 14 inches thick. The substratum is pale-brown very gravelly silt loam that extends to a depth of 60 inches or more. The surface layer is mildly alkaline and slightly calcareous in the lower part. The subsoil and substratum are moderately alkaline and moderately calcareous. A layer of strong lime accumulation is at a depth of 32 inches.

Permeability is moderately rapid. Roots penetrate to a depth of more than 60 inches, but most roots are concentrated in the upper 30 inches of soil.

These soils are used about equally for range and nonirrigated crops. Some areas are used for wildlife habitat.

Representative profile of Hupp gravelly silt loam, 6 to 10 percent slopes, in range, 2,100 feet east and 1,300 feet north of the southwest corner of section 20, T. 13 N., R. 6 W., in the southeast area of Hansel Valley:

A11—0 to 6 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when

Figure 6.—**Profile of Hupp gravelly silt loam, 6 to 10 percent slopes.**

moist; weak, fine, subangular blocky structure that parts to weak, fine, granular; soft, friable, slightly sticky and nonplastic; common fine roots and few medium roots; about 20 percent gravel; mildly alkaline (pH 7.6); clear, smooth boundary.

A12—6 to 13 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; soft, friable, slightly sticky and slightly plastic; few fine and very fine roots; few, fine, discontinuous pores; about 25 percent gravel; mildly alkaline (pH 7.6); clear, smooth boundary.

A13—13 to 18 inches, brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few, very fine, discontinuous pores; slightly calcareous; about 35 percent gravel; mildly alkaline (pH 7.8); clear, smooth boundary.

B2—18 to 32 inches, pale-brown (10YR 6/3) very gravelly silt loam, brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine roots; common very fine tubular pores; about 50 percent gravel and cobblestones; few thin clay films on ped faces; moderately calcareous, lime is in laminar veins; moderately alkaline (pH 8.0); gradual, wavy boundary.

Cca—32 to 60 inches, pale-brown (10YR 6/3) very gravelly silt loam, brown (10YR 5/3) moist; weak, fine and medium, subangular blocky structure; hard, friable slightly sticky and slightly plastic; many, very fine discontinuous pores; about 50 percent gravel and cobblestones; moderately calcareous, lime is in veins; moderately alkaline (pH 8.4).

The solum ranges from 17 to 32 inches in thickness. Between depths of 10 and 40 inches, the texture averages very gravelly or very cobbly silt loam or very gravelly or very cobbly loam and the content of coarse fragments averages more than 50 percent. The coarse fragments are mainly gravel and cobblestone-sized angular fragments of limestone and sandstone. The content of coarse fragments ranges from 5 to 50 percent in the A1 horizon but is mainly 20 to 35 percent; 30 to 80 percent in the B2 horizon; and 50 to 90 percent in the C horizon. The soils are usually moist but are dry between depths of 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is silt loam, gravelly silt loam, very gravelly silt loam, gravelly loam, or very gravelly loam, and it ranges from 7 to 18 inches in thickness. The horizon is neutral to moderately alkaline and is generally noncalcareous, but it may be slightly calcareous in the lower part.

In the B2 horizon, value is 3 or 4 when the soils are moist; chroma ranges from 2 to 4. This horizon is very gravelly silt loam, very gravelly loam, or very cobbly loam. It is moderately or strongly alkaline and is noncalcareous to moderately calcareous, but mainly is moderately calcareous. A few clay films are on ped faces in places.

In the Cca horizon, value is 5 or 6 when the soils are dry and ranges from 3 to 5 when they are moist; chroma ranges from 2 to 4. Texture is very gravelly silt loam, very cobbly silt loam, very gravelly loam, very cobbly loam, very gravelly sandy loam, very gravelly loamy sand, or very cobbly loamy sand. Reaction is moderately alkaline to very strongly alkaline. The Cca horizon is moderately calcareous to strongly calcareous; gravel and cobblestones have thin coatings of lime on the bottom surfaces.

Hupp gravelly silt loam, 1 to 6 percent slopes (HpB).—This soil is on alluvial fans. Slopes are slightly convex and medium in length. Runoff is slow, and the hazard of erosion is slight. The rate of water intake is rapid. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of DeJarnet gravelly silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Sterling gravelly loam, 1 to 6 percent slopes.

This soil is used about equally for range and nonirrigated small grains. It is also used for wildlife habitat. Capability unit IVs–UZ, nonirrigated; Upland Stony Loam range site.

Hupp gravelly silt loam, 6 to 10 percent slopes (HpD).—This soil is mainly on east- and west-facing slopes on alluvial fans. Slopes are slightly convex and are medium in length to long. A profile of this soil is the one described as representative for the Hupp series. Runoff is medium and the hazard of erosion is moderate. The rate of water intake is rapid. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Sterling gravelly loam 6 to 20 percent slopes.

This soil is used mainly for range and nonirrigated small grains. It is also used for wildlife habitat. Capability unit IVs–UZ, nonirrigated; Upland Stony Loam range site.

Hupp silt loam, 3 to 6 percent slopes (HuC).—This soil is on east- and south-facing slopes on alluvial fans, mainly in Howell Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the Hupp series, but in the upper 9 to 16 inches the content of coarse fragments is only 5 to 15 percent. Runoff is medium, and the hazard of erosion is moderate. The rate of water intake is moderate. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Sterling gravelly loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife habitat, and a very small area is used for range. Capability unit IVs–UZ, nonirrigated; range site not assigned.

Hupp silt loam, 6 to 10 percent slopes (HuD).—This soil is on east- and south-facing slopes on alluvial fans, mainly in Howell Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the series, but in the upper 9 to 16 inches the content of coarse fragments is only 5 to 15 percent. Runoff is medium, and the hazard of erosion is moderate. The rate of water intake is moderate. Available water holding capacity is about 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used mainly for nonirrigated small grains and alfalfa. Some areas are used for wildlife habitat, and a very small area is used for range. Capability unit IVs–UZ, nonirrigated; range site not assigned.

James Canyon Series

The James Canyon series consists of somewhat poorly drained soils. These soils are on alluvial fans in the vicinity of Brigham City and Willard. They formed in alluvium derived mainly from quartzite and sandstone. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas consists of bluegrass, wiregrass, sedges, foxtail, and clover. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 150 to 160 days. Elevations range from 4,250 to 4,300 feet.

In a representative profile, the surface layer is very dark gray and dark-gray loam about 35 inches thick. The underlying layers, extending to a depth of about 60 inches, are gray gravelly loam and gravelly sandy loam. The soils are neutral throughout.

Permeability and the rate of water intake are both moderate. Available water holding capacity is 7 to 10 inches to a depth of 5 feet. Most roots are in the top 36 inches but may extend to a depth of 60 inches.

James Canyon soils are used for irrigated crops and native pasture.

Representative profile of James Canyon loam, 0 to 3 percent slopes, in a cultivated area, 120 feet north and 480 feet west of the south quarter corner of section 12, T. 9 N., R. 2 W., one-half mile north of the Brigham City Golf Course:

Ap—0 to 8 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; neutral (pH 7.3); abrupt, smooth boundary.

A11—8 to 15 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine pores; neutral (pH 7.2); gradual, wavy boundary.

A12—15 to 35 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; common fine roots; few fine pores; neutral (pH 7.2); gradual, wavy boundary.

C1—35 to 40 inches, gray (10YR 5/1) gravelly loam, very dark gray (10YR 3/1) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; 35 percent gravel; neutral; gradual, irregular boundary.

C2—40 to 60 inches, gray (10YR 5/1) gravelly sandy loam, very dark gray (10YR 3/1) when moist; massive; slightly hard, friable, nonsticky and nonplastic; 40 percent gravel; neutral (pH 7.3).

Texture between depths of 10 and 40 inches averages loam. Depth to the water table usually ranges from 20 to 40 inches, but if the soils are drained, the water table is at a depth below 40 inches.

In the A1 horizon, value is 3 or 4 when the soils are dry. Texture is loam or light loam, and content of gravel ranges from 5 to 20 percent. Reaction is neutral to moderately alkaline. The A1 horizon ranges from 26 to 36 inches in thickness.

In the C horizon, hue is 10YR or 2.5Y; value ranges from 4 to 6 when the soils are dry and from 2 to 4 when they are moist; and chroma is 1 or 2. Texture is gravelly loam, gravelly sandy loam, or very gravelly sandy loam, and content of gravel ranges from 20 to 70 percent. Reaction is neutral to moderately alkaline.

James Canyon loam, 0 to 3 percent slopes (JaA).—This soil is on alluvial fans in the vicinity of Brigham City and Willard. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Wasatch gravelly sandy loam, 3 to 10 percent slopes; Roshe Springs silt loam; and Draper loam, 0 to 3 percent slopes.

Where the water table is controlled by subsurface tile drainage or by diverting water that would normally enter the profile, this soil is used for irrigated crops. Common crops are alfalfa, tomatoes, sugar beets, melons, corn for silage, irrigated pastures, and small grains. Where the water table is not controlled, this soil supports a pasture of bluegrass, sedges, wiregrass, meadow foxtail, and clover that can be mowed for hay. Capability unit IIw–2, irrigated; Semiwet Meadow range site.

Kapod Series

The Kapod series consists of well-drained soils. These soils are on lake terraces and foot slopes west of Garland. They formed in very cobbly and stony alluvium and mixed lake sediments derived mainly from sandstone and limestone. Slopes range from 6 to 20 percent. The vegetation consists of bluebunch wheatgrass, Great Basin wildrye, western wheatgrass, big sagebrush, snakeweed, cheatgrass, and annual weeds. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,500 to 5,000 feet.

In a representative profile, the surface layer is dark-brown very cobbly loam about 13 inches thick. Content of stones is about 5 percent (fig. 7). The subsoil is brown very cobbly sandy clay loam and pale-brown very cobbly loam about 18 inches thick. Content of stones is about 5 percent. The substratum is very pale brown very gravelly loam that extends to a depth of about 66 inches. The surface layer is moderately alkaline, the subsoil is moderately alkaline and slightly calcareous or moderately calcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 6 to 7 inches before moisture is depleted. Roots penetrate to a depth of more than 60 inches.

These soils are used for range and wildlife habitat.

Representative profile of Kapod stony loam, 6 to 20 percent slopes, in range, 1,600 feet south and 160 feet west of the north quarter corner of section 29, T. 12 N., R. 3 W., on foothills west of Garland:

A11—0 to 6 inches, dark-brown (10YR 3/3) very cobbly loam, very dark brown (10YR 2/2) when moist; weak, thick, platy and medium, subangular blocky structure that parts to moderate, fine, granular; soft, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; about 50 percent cobblestones and gravel and 5 percent stones; moderately alkaline (pH 8.0); clear, smooth boundary.

A12—6 to 13 inches, dark-brown (10YR 3/3) very cobbly loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular; soft, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; about 60 percent cobblestones and gravel and 5 percent stones; moderately alkaline (pH 8.2); clear, smooth boundary.

B21t—13 to 18 inches, brown (10YR 4/3), very cobbly sandy clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and coarse, subangular blocky structure; slightly hard, firm, sticky and plas-

Figure 7.—**Profile of Kapod stony loam, 6 to 20 percent slopes.**

tic; few fine and very fine roots; few fine and very fine pores; many thin clay films on ped faces; slightly calcareous; 70 percent cobblestones and gravel and 5 percent stones; moderately alkaline (pH 8.2); clear, wavy boundary.

B22t—18 to 31 inches, pale-brown (10YR 6/3) very cobbly loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; few fine pores; common thin clay films on ped faces; moderately calcareous; about 70 percent cobblestones and gravel and 5 percent stones; moderately alkaline (pH 8.2); abrupt, wavy boundary.

C1ca—31 to 52 inches, very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) when moist; massive; hard, firm, sticky and slightly plastic; few fine roots; few fine pores; about 70 percent gravel; strongly calcareous, lime is in veins; strongly alkaline (pH 8.7); clear, wavy boundary.

C2—52 to 66 inches, very pale brown (10YR 7/3) very gravelly loam, light yellowish brown (10YR 6/4) when moist; massive; hard, firm, sticky and slightly plastic; about 50 percent gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

The solum ranges from 20 to 33 inches in thickness. Coarse fragments are mainly subrounded sandstone and limestone. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value ranges from 3 to 5 when the soils are dry and is 2 or 3 when they are moist; chroma is 2 or 3. Texture is cobbly loam or very cobbly loam that is 40 to 60 percent cobblestones and gravel and 5 to 10 percent stones. Reaction is neutral to moderately alkaline. Thickness of the A1 horizon ranges from 8 to 13 inches.

In the B2t horizon, value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly sandy clay loam or very cobbly loam, and the content of coarse fragments ranges from 50 to 80 percent cobblestones and gravel and from 5 to 10 percent stones. Reaction is neutral to moderately alkaline. Clay films are common to continuous and thin to moderately thick on ped faces. This horizon is 10 to 18 inches thick.

In the Cca and C horizons, value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly or very gravelly loam, very cobbly or very gravelly sandy loam, or very cobbly or very gravelly sand. Content of coarse fragments ranges from 50 to 85 percent gravel and cobblestones and some stones. Reaction is moderately alkaline or strongly alkaline. The C horizon is moderately to strongly calcareous and in some places is weakly cemented.

Kapod stony loam, 6 to 20 percent slopes (KaE).—This soil is on east- and south-facing slopes on lake terraces and foot slopes (fig. 8). It occurs as long, narrow, stony strips that are intermingled with areas of nonirrigated cropland. Most of the acreage is along the foothills west of Garland. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Bingham gravelly loam, 6 to 10 percent slopes; Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Middle cobbly silt loam, 10 to 30 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Kearns Series

The Kearns series consists of well-drained soils. These soils are on alluvial fans and lake terraces and are widely distributed throughout the survey area. They formed in alluvium and mixed lake sediments derived mainly from limestone, sandstone, and quartzite. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas is mainly bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, cheatgrass, and annual weeds. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 115 to 130 days. Elevations range from 4,350 to 5,250 feet.

In a representative profile, the surface layer is grayish-brown and brown silt loam about 9 inches thick. The subsoil is pale-brown silt loam about 6 inches thick. The substratum, between depths of 15 and 60 inches or more, is pale-brown silt loam and very pale brown silt loam and loam. The surface layer is moderately alkaline and slightly calcareous or noncalcareous; the subsoil is moderately alkaline and moderately calcareous; and the substratum is moderately alkaline to strongly alkaline and strongly calcareous or moderately calcareous. A layer of lime accumulation is at a depth of about 15 inches.

Figure 8.—**Kapod stony loam, 6 to 20 percent slopes, on south-facing lake terraces.**

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. The water-supplying capacity is 10 to 12 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches or more.

These soils are used mainly for nonirrigated crops and wildlife habitat. Small areas are used for irrigated crops.

Representative profile of Kearns silt loam, 3 to 6 percent slopes, in a cultivated area, 660 feet west and 660 feet south of the north quarter corner of section 31, T. 12 N., R. 5 W., about 4 miles south of the Howell post office:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine pores; slightly calcareous; moderately alkaline (pH 8.0); clear, smooth boundary.

A1—5 to 9 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many fine pores; noncalcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

B2—9 to 15 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

C1ca—15 to 20 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; strongly calcareous, lime is veined; moderately alkaline (pH 8.4); gradual, wavy boundary.

C2ca—20 to 39 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; moderately calcareous, lime is laminar and veined; strongly alkaline (pH 8.6); gradual, wavy boundary.

IIC3ca—39 to 76 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 13 to 27 inches. In places a few pebbles are on the surface and throughout the profile. Texture between depths of 10 and 40 inches averages silt loam. The soils are

usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, chroma is 2 or 3. This horizon is silt loam or loam and ranges from 7 to 14 inches in thickness. Reaction is mildly alkaline or moderately alkaline.

In the B2 horizon, hue is 10YR or 2.5Y; value ranges from 5 to 7 when the soils are dry and is 3 or 4 when they are moist; and chroma is 2 or 3. This horizon is silt loam or heavy silt loam and is 5 to 16 inches thick. It is mildly alkaline to strongly alkaline and noncalcareous to moderately calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam in the upper part but may be fine sandy loam, loam, or silt loam in the lower part. This horizon is strongly alkaline to very strongly alkaline.

Kearns silt loam, 1 to 3 percent slopes (KeB).—This soil is on alluvial fans and lake terraces. Slopes are slightly convex and medium in length. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Fridlo silt loam; Hansel silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for irrigated alfalfa, small grains, corn for silage, and sugar beets and also for wildlife habitat. Capability unit IIc-2, irrigated; capability unit IIIe-U, nonirrigated; range site not assigned.

Kearns silt loam, 3 to 6 percent slopes (KeC).—This soil is on terraces and broad, long alluvial fans. A profile of this soil is the one described as representative for the Kearns series. Runoff is slow, and the hazard of erosion is slight in nonirrigated areas and moderate in irrigated areas.

Included with this soil in mapping are small areas of Hansel silt loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; Thiokol silt loam, 1 to 6 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Small areas are used for irrigated alfalfa, small grains, and corn for silage and irrigated pasture and also for wildlife habitat. Capability unit IIe-2, irrigated; capability unit IIIe-U, nonirrigated; range site not assigned.

Kearns silt loam, 6 to 10 percent slopes (KeD).—This soil is on lake terraces and alluvial fans. Slopes are slightly convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate. Rill erosion is common, and there are a few shallow gullies.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 3 to 6 percent slopes; Thiokol silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used mainly for nonirrigated small grains and for wildlife habitat. Some areas are used for irrigated alfalfa and small grains. Capability unit IIIe-U, nonirrigated; range site not assigned.

Kearns silt loam, 10 to 20 percent slopes (KeE).—This soil is on alluvial fans. Slopes are convex and short. Runoff is rapid, and the hazard of erosion is high. Rill erosion is common, and there are a few shallow gullies.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Parleys silt loam, 10 to 20 percent slopes.

This soil is used for nonirrigated small grains and wildlife habitat. Capability unit IVe-U, nonirrigated; range site not assigned.

Kearns-Stingal complex, 6 to 10 percent slopes (KgD).—This complex is on intermediate and high lake terraces and alluvial fans in the south-central part of the survey area. It consists of about 50 percent Kearns silt loam, 6 to 10 percent slopes, and 40 percent Stingal silt loam, 6 to 10 percent slopes. Included with these soils in mapping are areas of Eccles fine sandy loam, 6 to 10 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes. These included areas make up about 10 percent of the total acreage.

These soils are intermingled. The Stingal soil is on convex knolls and ridges, and the Kearns soil is in slightly concave areas between the knolls and ridges. Average annual precipitation is 13 to 14 inches. Runoff is medium, and the hazard of erosion is moderate for these soils.

This complex is in capability unit IVe-UZ, nonirrigated; range site not assigned.

Kearns Series, High Lime Variant

The Kearns series, high lime variant, consists of well-drained soils. These soils are in Pocatello Valley and are on alluvial fans and foothill slopes that are slightly above the highest lake terraces. They formed in alluvium and colluvium derived mainly from limestone and sandstone. Slopes range from 6 to 20 percent. The vegetation in noncultivated areas is dominantly bluebunch wheatgrass, slender wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 45° to 49° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 110 to 130 days. Elevations range from 5,175 to 5,500 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 8 inches thick. The subsoil is pale-brown light clay loam about 4 inches thick. The substratum, extending to a depth of about 60 inches, is very pale brown clay loam in the upper part and sandy clay loam in the lower part. The surface layer is moderately alkaline and slightly calcareous, the subsoil is moderately alkaline and strongly or very strongly calcareous, and the substratum is strongly alkaline and strongly or very strongly calcareous. A layer of lime accumulation is at a depth of about 12 inches and is weakly cemented below a depth of 18 inches.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. The water-supplying capacity is 12 to 13 inches before moisture is depleted. Roots are mainly in the upper 30 inches of the soil but may penetrate to a depth of more than 60 inches.

These soils are used for nonirrigated crops.

Representative profile of Kearns silt loam, high lime variant, 10 to 20 percent slopes, in a cultivated area, 1,700 feet west and 50 feet south of the southeast corner of section 15, T. 14 N., R. 6 W., northern Blue Creek Valley:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few very fine roots; slightly

calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary.

B2—8 to 12 inches, pale-brown (10YR 6/2) light clay loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

C1ca—12 to 18 inches, very pale brown (10YR 8/3) clay loam, very pale brown (10YR 7/3) when moist; massive; hard, firm, sticky and slightly plastic; few fine and very fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.

C2ca—18 to 29 inches, very pale brown (10YR 8/3) light clay loam, very pale brown (10YR 7/3) when moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine pores; very strongly calcareous, weakly cemented, lime is disseminated, many lime nodules; strongly alkaline (pH 8.8); clear, wavy boundary.

C3ca—29 to 60 inches, very pale brown (10YR 8/3) light sandy clay loam, very pale brown (10YR 7/3) when moist; massive; extremely hard, friable, nonsticky and nonplastic; common very fine pores; 10 percent gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation ranges from 12 to 16 inches. Between depths of 10 and 40 inches, the texture averages clay loam and the content of clay ranges from 20 to 32 percent. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, chroma is 2 or 3. This horizon is slightly or moderately calcareous and ranges from 7 to 10 inches in thickness. In the B2 horizon, chroma is 2 or 3. This horizon is mainly clay loam but may be heavy silt loam. It is moderately calcareous or strongly calcareous and ranges from 4 to 6 inches in thickness.

In the Cca horizon, hue is 10YR or 7.5YR; value is 7 or 8 when the soils are dry and ranges from 5 to 7 when they are moist; and chroma is 3 to 4. Texture is clay loam or heavy silt loam in the upper part and sandy clay loam, loam, or sandy loam in the lower part. In places, this horizon is weakly to strongly cemented and contains few to many lime nodules.

Kearns silt loam, high lime variant, 10 to 20 percent slopes (KhE).—This mapping unit is on alluvial fans and foothill slopes in Pocatello Valley in areas that are slightly above the highest lake terraces. It consists of about 60 percent Kearns silt loam, high lime variant, 10 to 20 percent slopes, and 30 percent Hendricks silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Munk gravelly silt loam, 10 to 20 percent slopes; Parleys silt loam, 10 to 20 percent slopes; and Pomat silt loam, 10 to 30 percent slopes. These included soils make up about 10 percent of the total acreage.

The soils in this mapping unit are intermingled. The Kearns variant is on convex knolls and short, generally south-facing slopes. The Hendricks soil is on north- and east-facing slopes that are slightly concave.

Runoff is rapid, and the hazard of erosion is high. Sheet and rill erosion is moderate, and a few shallow gullies have been formed.

These soils are used for nonirrigated small grains. Capability unit IVe-U, nonirrigated; range site not assigned.

Kidman Series

The Kidman series consists of well-drained soils. These soils are on broad lake terraces and are widely distributed throughout the survey area. They formed in mixed lake sediments derived mainly from sandstone, limestone, and quartzite and from shore deposits that have been reworked by wind. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas is sagebrush, bluebunch wheatgrass, western wheatgrass, cheatgrass, and annual weeds. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 13 to 17 inches, and the frost-free period is 115 to 155 days. Elevations range from 4,250 to 5,150 feet.

In a representative profile, the surface layer is brown fine sandy loam about 14 inches thick. The subsoil is brown fine sandy loam about 15 inches thick. The substratum is light-gray, pinkish-gray, and very pale brown fine sandy loam that extends to a depth of about 60 inches. A layer of strong lime accumulation is at a depth of 29 inches. The surface layer and subsoil are moderately alkaline. The substratum is moderately alkaline to strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 7.5 to 9 inches to a depth of 5 feet. The water-supplying capacity is 10 to 11 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches or more.

These soils are used for irrigated and nonirrigated crops.

Representative profile of Kidman fine sandy loam, 0 to 2 percent slopes, in a cultivated area, at a point 590 feet east and 205 feet north of the south quarter corner of section 1, T. 11 N., R. 3 W., about 1½ miles east of Tremonton:

Ap—0 to 6 inches, brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, granular structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; moderately alkaline (pH 8.2); abrupt, smooth boundary.

A1—6 to 14 inches, brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine and medium, subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; moderately alkaline (pH 8.2); gradual, smooth boundary

B2—14 to 29 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; common fine and very fine tubular pores; few thin clay films as coatings on sand grains; few krotovinas one-half inch in diameter; moderately alkaline (pH 8.2); clear, wavy boundary.

C1ca—29 to 41 inches, light-gray (10YR 7/2) fine sandy loam, pale brown (10YR 6/3) when moist; weak, coarse, subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; strongly calcareous, lime is disseminated and nodular; moderately alkaline (pH 8.4); abrupt, wavy boundary.

C2ca—41 to 50 inches, pinkish-gray (7.5YR 6/2) fine sandy loam, brown (10YR 5/3) when moist; common, medium, faint, dark yellowish-brown (10YR 4/4) mottles; massive; hard, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

C3—50 to 60 inches, very pale brown (10YR 7/3) light fine sandy loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Depth to the horizon of carbonate accumulation ranges from 20 to 37 inches but is dominantly more than 28 inches. In places, a few pebbles are scattered on the surface and throughout the profile. Where the soils are irrigated, the depth to the water table ranges from 50 inches to 60 inches or more,

and common, fine to medium, faint mottles are below a depth of 40 inches. The soils are usually moist, but they are dry in all parts between depths of 8 to 24 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is fine sandy loam or light loam and ranges from 8 to 15 inches in thickness. It is mildly or moderately alkaline and generally noncalcareous, but in places it is slightly calcareous.

In the B2 horizon, value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; chroma is 2 or 3. This horizon is mainly fine sandy loam but may be loam. It is mildly alkaline to strongly alkaline and generally noncalcareous, but it is moderately calcareous in the lower part.

In the C horizon, hue is 7.5YR, 10YR, or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam, loam, fine sandy loam, or loamy fine sand but is dominantly fine sandy loam. Reaction is moderately alkaline to very strongly alkaline.

Kidman fine sandy loam, 0 to 2 percent slopes (KlA).—This soil is on broad, low lake terraces in the Bear River Valley. A profile of this soil is the one described as representative for the Kidman series. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 140 to 155 days

Included with this soil in mapping are small areas of Fielding silt loam, warm; Lewiston fine sandy loam; and Timpanogos loam, 0 to 3 percent slopes. Also included are some moderately well drained areas.

This soil is used for irrigated tomatoes, sugar beets, small grains, corn for silage, irrigated pasture, alfalfa, apples, stone fruits, and some truck crops. Capability unit I–1, irrigated; range site not assigned.

Kidman fine sandy loam, 2 to 4 percent slopes (KlB).—This soil is on medium-length, mainly west-facing slopes on low and intermediate lake terraces. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 140 to 155 days.

Included with this soil in mapping are small areas of Kidman fine sandy loam, 0 to 2 percent slopes, and Timpanogos loam, 0 to 3 percent slopes. Also included are areas of moderately well drained fine sandy loam having slopes of 2 to 10 percent.

This soil is used for irrigated tomatoes, sugar beets, alfalfa, small grains, corn for silage, cherries, apricots, peaches, apples, and irrigated pasture. Capability unit IIe–1, irrigated; range site not assigned.

Kidman loam, 0 to 1 percent slopes (KmA).—This soil is on broad, high lake terraces in Pocatello Valley. The profile of this soil is similar to the one described as representative for the series, but the surface layer is loam about 16 inches thick. Runoff is slow, and the erosion hazard is slight. Average annual precipitation is 16 to 17 inches. The frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Red Rock silt loam, 0 to 1 percent slopes, and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIc–U, nonirrigated; range site not assigned.

Kidman loam, 1 to 6 percent slopes (KmB).—This soil is on lake terraces. Slopes are medium in length and slightly convex. The profile of this soil is similar to that described as representative for the Kidman series, but it has a surface layer of loam about 16 inches thick. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation is 14 to 15 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 3 to 6 percent slopes; Stingal loam, 1 to 6 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe–U, nonirrigated; range site not assigned

Kidman loam, 6 to 10 percent slopes (KmD).—This soil is in small areas on lake terraces in the northwestern part of the survey area. The profile of this soil is similar to that described as representative for the Kidman series, but it has a surface layer of loam about 16 inches thick. Runoff is medium, and the hazard of erosion is moderate. Average annual precipitation is 14 to 15 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes, and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe–U, nonirrigated; range site not assigned.

Kidman loam, 10 to 20 percent slopes (KmE).—This soil is on somewhat dissected, intermediate and high lake terraces. Slopes are slightly convex and short to medium in length. The profile of this soil is similar to that described as representative for the Kidman series, but it has a surface layer of loam about 16 inches thick. Runoff is rapid, and the hazard of erosion is high. Average annual precipitation is 14 to 15 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kidman loam, 6 to 10 percent slopes; Pomat silt loam, 10 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used mainly for nonirrigated small grains, but a small area is used for range. Capability unit IVe–U, nonirrigated; Upland Loam range site.

Kilburn Series

The Kilburn series consists of somewhat excessively drained soils. These soils are on lake terraces, benches, and alluvial fans along the mountain front south of Brigham City and Mantua. They formed in alluvium derived from quartzite, gneiss, and schist. Slopes range from 1 to 60 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, big sagebrush, sand dropseed, western wheatgrass, annual grass, and annual weeds. Mean annual air temperature is 49° to 50° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 130 to 160 days. Elevations range from 4,275 to 5,150 feet.

In a representative profile, the surface layer is dark grayish-brown and brown gravelly sandy loam about 14 inches thick. The subsoil is brown gravelly loam about 8 inches thick. The substratum is brown very gravelly sandy loam and brown very gravelly loamy sand that extends to a depth of more than 60 inches. The surface layer is neutral, and the subsoil and substratum are mildly alkaline.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is 7.5 to 8 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

Kilburn soils are used for irrigated crops, range, and wildlife habitat.

Representative profile of Kilburn gravelly sandy loam, 10 to 20 percent slopes, in range, at a point one-fourth mile south of the north quarter corner of section 1, T. 8 N., R. 2 W., south of Brigham City:

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and few medium roots; 20 percent gravel; neutral (pH 7.2); clear, wavy boundary.

A12—8 to 14 inches, brown (10YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, nonsticky and slightly plastic; many fine and very fine and few medium roots; many very fine tubular pores; 20 percent gravel; neutral (pH 7.2); clear, wavy boundary.

B2—14 to 22 inches, brown (7.5YR 5/4) gravelly light loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and slightly plastic; common fine and very fine and few medium roots; many very fine tubular pores; 30 percent gravel; few thin clay films line pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

C1—22 to 35 inches, brown (7.5YR 5/4) very gravelly light sandy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; soft, very friable; few very fine roots; 60 percent gravel; mildly alkaline (pH 7.6); gradual, wavy boundary.

C2—35 to 60 inches, brown (7.5YR 5/3) very gravelly loamy sand, brown (7.5YR 4/3) when moist; single grained; loose; few very fine roots; 55 percent gravel; mildly alkaline (pH 7.6).

The solum ranges from 21 to 32 inches in thickness. Coarse fragments are mostly rounded gravel, and their content ranges from 20 to 40 percent in the A1 horizon; 25 to 60 percent in the B2 horizon; and 40 to 80 percent in the C horizon. The soils are dry in all parts between depths of 12 and 35 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is generally gravelly sandy loam but is loam in some areas. Reaction is neutral or mildly alkaline. Thickness of the A1 horizon ranges from 10 to 18 inches.

In the B2 horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture is gravelly loam or gravelly sandy loam. Reaction is neutral or mildly alkaline. Thickness of the B2 horizon ranges from 7 to 14 inches.

In the C horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and from 3 to 5 when they are moist. Texture is gravelly loam, very gravelly loam, gravelly sandy loam, very gravelly sandy loam, or very gravelly loamy sand. Reaction is neutral or mildly alkaline.

Kilburn gravelly sandy loam, 3 to 6 percent slopes (KnC).—This soil is on west- and north-facing alluvial fans at the base of mountains. The profile of this soil is similar to that described as representative for the Kilburn series, but the subsoil is 14 inches thick. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 160 days. A very small acreage of this soil is in Mantua Valley where slightly cooler weather prevails.

Included with this soil in mapping are small areas of Kilburn gravelly loam, 1 to 3 percent slopes.

This soil is used for irrigated apricots, peaches, cherries, apples, alfalfa, melons, tomatoes, corn for silage, small grains, and irrigated pasture. Capability unit IIIe–16, irrigated; range site not assigned.

Kilburn gravelly sandy loam, 6 to 10 percent slopes (KnD).—This soil is on west-facing alluvial fans at the base of mountains. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 3 to 6 percent slopes, and Kilburn gravelly sandy loam, 20 to 30 percent slopes.

This soil is used mainly for irrigated apricots, peaches, cherries, apples, alfalfa, melons, tomatoes, corn for silage, and small grains. Some areas are used for range. Capability unit IVe–16, irrigated; range site not assigned.

Kilburn gravelly sandy loam, 10 to 20 percent slopes (KnE).—This soil is on west-facing alluvial fans and lake terraces and benches at the base of mountains. A profile of this soil is the one described as representative for the Kilburn series. Runoff is medium, and the hazard of erosion is moderate. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 6 to 10 percent slopes; Kilburn gravelly sandy loam, 20 to 30 percent slopes; and Stony alluvial land.

This soil is used mainly for irrigated apricots, peaches, cherries, apples, grapes, and alfalfa. It is also used for range and wildlife habitat. Capability unit IVe–16, irrigated; capability unit VIs–U, nonirrigated; Upland Stony Loam range site.

Kilburn gravelly sandy loam, 20 to 30 percent slopes (KnF).—This soil is on west-facing lake-terrace escarpments and alluvial fans at the base of mountains. Runoff is medium, and the hazard of erosion is moderate. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 10 to 20 percent slopes; Kilburn gravelly sandy loam, 30 to 60 percent slopes; Wasatch gravelly sandy loam, 10 to 25 percent slopes; and Stony alluvial land.

This soil is used for range and wildlife habitat. Capability unit VIs–U, nonirrigated; Upland Stony Loam range site.

Kilburn gravelly sandy loam, 30 to 60 percent slopes (KnG).—This soil is on west-facing lake-terrace escarpments at the base of mountains. The profile of this soil is similar to that described as representative for the Kilburn series, but the surface layer ranges from 10 to 14 inches in thickness. Runoff is rapid, and the hazard of erosion is high. Elevations range from 4,700 to 5,150 feet. The frost-free period is from 130 to 150 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 20 to 30 percent slopes, and Stony alluvial land.

This soil is used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Kilburn gravelly loam, 1 to 3 percent slopes (KoB).—This soil is on west-facing alluvial fans at the base of mountains. The profile of this soil is similar to that described as representative for the Kilburn series, but the surface layer is generally gravelly loam and the subsoil is 12 to 14 inches thick. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 160 days. A very small acreage of this soil is in Mantua Valley where slightly cooler weather prevails.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 3 to 6 percent slopes, and Wasatch gravelly sandy loam, 3 to 10 percent slopes.

This soil is used for irrigated apricots, peaches, cherries, apples, alfalfa, melons, tomatoes, corn for silage, small grains, and irrigated pasture. Capability unit IIIs–16, irrigated; range site not assigned.

Kirkham Series

The Kirkham series consists of somewhat poorly drained soils. These soils are on flood plains and low river terraces along the Malad River and Bear River in the eastern part of the survey area. They formed in mixed, calcareous, stratified alluvium derived dominantly from limestone, sandstone, and quartzite. Slopes range from 0 to 2 percent. The vegetation in noncultivated areas is mainly saltgrass, foxtail, wiregrass, Great Basin wildrye, greasewood, sour dock, alkali mallow, povertyweed, and cheatgrass. Mean annual air temperature ranges from 48° to 52° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,215 to 4,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 10 inches thick. The underlying layer, extending to a depth of 60 inches or more, is highly stratified material; it is light brownish-gray loam in the upper part and grayish-brown and light brownish-gray silty clay loam in the lower part. These soils are strongly calcareous throughout. The upper 5 inches of the surface layer is moderately alkaline. Between depths of 5 and 60 inches or more, the soils are strongly to very strongly alkaline.

Permeability is moderately slow, and the rate of water intake is moderate. Because of the salt content, the water available to plants is only about 7 to 10 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of 60 inches.

Kirkham soils are used for native pasture and irrigated crops.

Representative profile of Kirkham silt loam, in range, 775 feet east and 1,475 feet south of the north quarter corner of section 10, T. 11 N., R. 3 W., about one-fourth mile southeast of Tremonton:

A11—0 to 5 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); abrupt, smooth boundary.

A12—5 to 10 inches, grayish-brown (2.5Y 5/2) silt loam, very dark gray (10YR 3/1) when moist; weak, very coarse, granular structure that parts to weak, medium, granular; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; few fine and medium interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); abrupt, wavy boundary.

C1—10 to 16 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, nonsticky and slightly plastic; common fine and very fine roots; common fine and medium interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); abrupt, wavy boundary.

A1b1—16 to 25 inches, grayish-brown (2.5YR 5/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine interestitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, smooth boundary.

C2g—25 to 36 inches, light brownish-gray (2.5Y 6/2) silty clay loam, very dark gray (10YR 3/1) when moist; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine and very fine roots; many fine and medium interstitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, smooth boundary.

A1b2g—36 to 44 inches, grayish-brown (2.5Y 5/2) heavy silty clay, very dark gray (10YR 3/1) when moist; weak, fine and medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine and very fine roots; many fine and medium interstitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, wavy boundary.

C3g—44 to 54 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark gray (5Y 4/1) when moist; massive; very hard, firm, slightly sticky and plastic; few fine and very fine roots; common fine and medium interstitial pores; few snail shells; strongly calcareous, lime is dissiminated; strongly alkaline (pH 8.6); clear, wavy boundary.

C4g—54 to 68 inches, gray (5Y 6/1) silty clay loam, dark gray (5Y 4/1) when moist; massive; very hard, firm, sticky and plastic; few fine and very fine roots; common fine and medium interstitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6).

The solum ranges from 10 to 18 inches in thickness. Between depths of 10 and 40 inches, the texture averages silty clay loam and the content of clay ranges from 27 to 35 percent. Few marine or snail shells are found in places throughout the profile. These soils commonly have recent deposition on the surface that ranges from 4 to 8 inches in thickness.

In the A1 horizon, hue is 10YR or 2.5Y; value is 2 or 3 when the soils are moist; and chroma is 1 or 2. Texture is silt loam, heavy silt loam, or light silty clay loam. Reaction is moderately alkaline to very strongly alkaline. A dark-colored, buried A1 horizon is at a depth below 15 inches. Content of organic matter decreases irregularly with increasing depth.

In the C horizon, hue is 10YR, 2.5Y, or 5Y; value ranges from 5 to 7 when the soils are dry and from 2 to 5 when they are moist; and chroma is 1 or 2. This horizon is silty clay loam, silt loam, or loam and is stratified with thin layers of very fine sandy loam. The water table fluctuates with the season but is at a depth ranging from 20 to 50 inches. In spring the water table is at or near the surface for many weeks. Faint to distinct mottles or chromas of 1 are at depths between 20 and 40 inches. Reaction is strongly alkaline to very strongly alkaline. These soils are slightly to moderately affected by salts and alkali.

Kirkham silt loam (Kr).—This soil is on flood plains and low river terraces along the Malad River and the Bear River. Slopes are 0 to 2 percent. The surface is quite uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight. This soil is subject to overflow or flooding in spring. Streambanks have been cut in places.

Included with this soil in mapping are small areas of Fresh water marsh, Logan silty clay loam, Martini fine sandy loam, and Sunset silt loam.

This soil is used for native pasture and irrigated crops. Where flooding is controlled and the soil drained, it is used for irrigated small grains, corn for silage, alfalfa, and improved pasture. A small area of this soil is used for nonirrigated small grains. Capability unit IVw–28, irrigated; Alkali Bottom range site.

Lakeshore Series

The Lakeshore series consists of poorly drained soils that have stratified layers with an average texture of

loam or fine sandy loam. These soils are on broad stream flood plains southwest of Honeyville. They formed in alluvium deposited over mixed lake sediments. Slopes are less than 1 percent. Vegetation consists of a sparse cover of saltgrass and pickleweed. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 130 to 140 days. Elevations range from 4,220 to 4,240 feet.

In a representative profile, the soil has stratified layers of gray, light-gray, and white fine sandy loam, loam, silt loam, and light silty clay loam. These layers extend from the surface to a depth of more than 60 inches, and buried surface layers are common. These soils are very strongly saline throughout and are strongly to moderately alkaline. Commonly, platy crusts of salt are on the surface and are underlain by layers of soft, granular material.

Permeability is slow, and the rate of water intake is slow. Because of the high salt content, the water available to plants is only 3 to 5 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 11 inches to that depth. Roots may penetrate to a depth of 60 inches or more.

These soils are used for range and for wildlife habitat.

Representative profile of Lakeshore fine sandy loam, in range, 750 feet east and 400 feet south of north quarter corner of section 21, T. 10 N., R. 2 W., south of the town of Honeyville:

C1sa—0 to 2 inches, light-gray (2.5Y 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, thin, platy structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and very fine pores; strongly calcareous; very strongly saline; strongly alkaline (pH 8.6); abrupt, smooth boundary.

C2sa—2 to 6 inches, light-gray (2.5Y 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and very fine pores; strongly calcareous; very strongly saline; strongly alkaline (pH 8.6); abrupt, smooth boundary.

C3sa—6 to 17 inches, light-gray (2.5Y 7/2) loam, dark gray (2.5Y 4/1) when moist; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; strongly alkaline (pH 8.8); abrupt, smooth boundary.

A1b1—17 to 18 inches, gray (10YR 5/1) heavy silt loam, black (10YR 2/1) when moist; massive; hard, friable, sticky and plastic; many fine and very fine pores; moderately calcareous; very strongly saline; strongly alkaline (pH 8.8); gradual, smooth boundary.

C4sa—18 to 25 inches, light-gray (2.5Y 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; single grained; loose; many fine and very fine pores; strongly calcareous; very strongly saline; strongly alkaline (pH 8.8); gradual, smooth boundary.

A1b2—25 to 32 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; massive; hard, friable, sticky and plastic; many fine and very fine pores; slightly calcareous; very strongly saline; moderately alkaline (pH 8.2); abrupt, smooth boundary.

C5sa—32 to 39 inches, white (2.5Y 8/2) loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, nonsticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4); clear, smooth boundary.

C6sa—39 to 48 inches, light-gray (10YR 7/1) light silty clay loam, very dark grayish brown (10YR 3/2) when moist; massive; very hard, friable, sticky and plastic; many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4); clear, smooth boundary.

C7sa—48 to 53 inches, light-gray (10YR 7/1) loam, very dark gray (2.5Y 3/1) when moist; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4); abrupt, smooth boundary.

C8sa—53 to 64 inches, light-gray (10YR 7/1) heavy loam, very dark gray (10YR 3/1) when moist; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4).

The soils are usually moist, and the water table is at or near the surface all the time. Between depths of 10 and 40 inches, the texture is light silt loam or fine sandy loam and the content of clay averages less than 18 percent. In the Csa horizon, hue is 10YR or 2.5Y; value ranges from 5 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma is 1 or 2. Content of salt averages more than 2 percent to a depth of more than 4 feet.

Lakeshore fine sandy loam (LA).—This soil is on broad flood plains of streams. Slopes most commonly are less than 1 percent. Runoff is very slow, and there is no erosion hazard.

Included with this soil in mapping are small areas of Syracuse fine sandy loam and Playas.

This soil is used for range and for wildlife habitat. In some areas, fresh water has been spread on the surface and has washed or leached out some of the salts. In these areas, a good stand of saltgrass has been established. Capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Lasil Series

The Lasil series consists of somewhat poorly drained soils that are affected by alkali. These soils are on valley plains and low lake terraces. They formed in mixed lake sediments. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is saltgrass, greasewood, alkali sacaton, annual weeds, and grasses. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation is 11 to 14 inches, and the frost-free period is 100 to 150 days. Elevations range from 4,220 to 4,525 feet.

In a representative profile, the surface layer is light brownish-gray and pale-brown silt loam about 9 inches thick. The subsoil is pale-brown, light-gray, and very pale brown silty clay loam about 14 inches thick. The substratum, extending to a depth of 60 inches, is very pale brown and white silty clay loam. The surface layer is noncalcareous and moderately alkaline. The subsoil and substratum are mostly moderately calcareous or strongly calcareous and moderately alkaline or strongly alkaline.

Permeability is slow, and the rate of water intake is slow. Roots penetrate easily to a depth of 60 inches, but most of them are at a depth within 24 inches.

These soils are used for irrigated and nonirrigated crops and for range.

Representative profile of Lasil silt loam, in a cultivated field, 1,320 feet south and 400 feet east of the northwest corner of section 20, T. 12 N., R. 5 W., about 1 mile south of Howell:

Ap1—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; few very fine, fine, and medium

roots; many very fine pores; moderately alkaline (pH 8.0); clear, smooth boundary.

Ap2—6 to 9 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 3/3) when moist; weak, very fine, subangular blocky structure; soft, friable, slightly sticky and plastic; few very fine, fine, and medium roots; many very fine pores; moderately alkaline (pH 8.0); clear, wavy boundary.

B21t—9 to 13 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and very fine, angular blocky; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; many very fine pores; common, thin to moderately thick clay films on ped faces; moderately alkaline (pH 8.0); clear, wavy boundary.

B22tca—13 to 19 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to weak, fine and very fine, angular blocky; very hard, very firm, sticky and plastic; few very fine, fine, and medium roots; common very fine pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.

B3ca—19 to 23 inches, very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; weak and moderate, fine, subangular blocky structure; hard, firm, sticky and plastic; few very fine and medium roots; common very fine pores; strongly calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.

C1ca—23 to 36 inches, very pale brown (10YR 8/3) silty clay loam, pale brown (10YR 6/3) when moist; common, medium, distinct, brown (10YR 5/3) mottles in lower half of horizon; weak, medium, subangular blocky structure; hard, friable, sticky and slightly plastic; few fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2—36 to 44 inches, very pale brown (10YR 8/3) silty clay loam, brown (10YR 5/3) when moist; common, medium, distinct, brown (10YR 4/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and few fine pores; strongly calcareous; strongly alkaline (pH 8.8); gradual, irregular boundary.

C3—44 to 60 inches, white (10YR 8/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; common, medium, distinct, brown (10YR 5/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; strongly calcareous, lime is veined; strongly alkaline (pH 9.0).

Depth to the horizon of carbonate accumulation ranges from 10 to 18 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for as much as 60 consecutive days in summer. Depth to the water table is 20 to 40 inches unless the soils are drained.

In the A1 horizon, hue ranges from 10YR to 2.5Y; chroma is 2 or 3. This horizon is silt loam or loam and ranges from 5 to 11 inches in thickness. It is mildly alkaline to very strongly alkaline and noncalcareous to moderately calcareous.

In the B2t horizon, hue is generally 10YR or 2.5Y but is 7.5YR in some places near Portage; value ranges from 6 to 8 when the soils are dry and from 3 to 5 when they are moist; and chroma is 2 or 3. This horizon is silty clay loam or heavy loam and is 3 to 10 inches thick. It has weak to strong, medium to coarse, prismatic structure, is moderately alkaline to very strongly alkaline, and is noncalcareous to strongly calcareous. Clay films in the B21t subhorizon are common to continuous and thin to thick on ped faces.

In the B3ca horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when the soils are moist; and chroma ranges from 2 to 4. This horizon is silty clay loam or heavy loam and is 0 to 10 inches thick. It is strongly alkaline to very strongly alkaline and is moderately calcareous to strongly calcareous.

In the C horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when the soils are moist; and chroma ranges from 2 to 4. Texture is silty clay loam, silt loam, or very fine sandy loam. Reaction is strongly alkaline or very strongly alkaline.

Lasil silt loam (Lc).—This soil is on valley plains and low lake terraces. A profile of this soil is the one described as representative for the Lasil series. The subsoil and substratum are silty clay loam, and the exchangeable sodium percentage ranges from 25 to 60 percent. Slopes most commonly are less than 1 percent. Runoff is slow, and the hazard of erosion is slight. This soil is strongly affected by salts and alkali. Its water-holding capacity is 11 to 12 inches to a depth of 5 feet, but the water available to plants is only 4 to 8 inches because the salt content is so high. The frost-free period is 100 to 130 days.

Included with this soil in mapping are small areas of Fridlo silt loam and Payson silt loam.

This soil is used mainly for range. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Lasil silt loam, moderately alkali (Ld).—This soil is on valley plains and low lake terraces. The profile of this soil is similar to that described as representative for the Lasil series. The subsoil and substratum are silty clay loam, light clay loam, heavy silt loam, or heavy loam. Exchangeable sodium percentage ranges from 15 to 25 percent in the subsoil and substratum. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. This soil is slightly to moderately affected by salts and alkali. Its water-holding capacity is 11 to 12 inches to a depth of 5 feet, but the water available to plants is only 7 to 9 inches because of the salt content. The frost-free period is from 140 to 150 days.

Included with this soil in mapping are small areas of Fridlo silt loam, moderately alkali; Airport silt loam; Warm Springs fine sandy loam; and Lewiston fine sandy loam.

This soil is used for irrigated crops and pasture. Under irrigation, the soil grows alfalfa, small grains, sugar beets, tomatoes, and corn for silage. Native pastures are mostly saltgrass, alkali sacaton, and greasewood. Improved pastures grow heavy stands of tall wheatgrass. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Lasil-Airport silt loams (Lr).—This complex is on the valley plain near the Malad River in the vicinity of Portage. It consists of about 45 percent Lasil silt loam and 45 percent Airport silt loam, strongly alkali. Included with these soils in mapping are areas of Fridlo silt loam, Kirkham silt loam, and Airport silt loam. These included areas make up about 10 percent of the total acreage.

These soils are intermingled and have a microrelief difference of 12 to 24 inches in elevation. The Lasil soil is in higher, slightly convex positions, and the Airport soil is in lower, slightly concave positions. Both soils formed under a cover of saltgrass, alkali sacaton, and greasewood.

Lasil silt loam in this complex has a profile similar to that described as representative for the Lasil series, but the subsoil has a hue of 10YR or 7.5YR and a texture of silty clay loam or clay loam. Exchangeable sodium percentage ranges from 25 to 50 percent. Airport silt loam, strongly alkali, has a profile similar to that described as representative for the Airport series, but the surface layer is 8 to 11 inches thick, the soil is very strongly alkali, and the frost-free period is 110 to 130 days.

The soils of this complex are used for range. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Lewiston Series

The Lewiston series consists of somewhat poorly drained soils. These soils are on low lake terraces, lake plains, and river flood plains in the area near Corinne. They formed in moderately coarse textured lake sediments and mixed alluvium derived dominantly from limestone, sandstone, and quartzite. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is Great Basin wildrye, saltgrass, foxtail, alkali sacaton, and annual weeds. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 140 to 155 days. Elevations range from 4,225 to 4,250 feet.

In a representative profile, the surface layer is grayish-brown and brown fine sandy loam about 15 inches thick. Below this is a layer of white fine sandy loam about 14 inches thick. The next layer, extending to a depth of 60 inches or more, is very pale brown fine sandy loam in the upper part and loamy fine sand in the lower part. The surface layer is slightly calcareous, and the underlying layers are strongly calcareous or moderately calcareous. A layer of strong lime accumulation is at depth of 15 inches. The soil is moderately alkaline to strongly alkaline.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 6.5 to 8.5 inches to a depth of 5 feet. Roots penetrate easily to the water table and, if the soils are drained, may extend to a depth of 60 inches or more.

Lewiston soils are used for irrigated crops.

Representative profile of Lewiston fine sandy loam, in a cultivated field, 225 feet east and 170 feet north of the southwest corner of section 28, T. 10 N., R. 2 W., about 2 miles northeast of Corinne:

Ap—0 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; slightly calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary.

A12—10 to 15 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; soft, very friable, nonsticky and nonplastic; many very fine pores; slightly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

C1ca—15 to 29 inches, white (10YR 8/2) fine sandy loam, pale brown (10YR 6/3) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few fine and very fine roots; many very fine pores; many krotovinas ½ to 1 inch in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2—29 to 40 inches, very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) when moist; many, medium, faint, yellowish-brown (10YR 5/6) mottles; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); diffuse, wavy boundary

C3—40 to 70 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) when moist; many, medium, faint, yellowish-brown (10YR 5/6) mottles; single grained; loose; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth to the horizon of carbonate accumulation is 14 to 15 inches. Texture between depths of 10 and 40 inches averages fine sandy loam. Depth to the water table ranges from 26 to 40 inches where the soils have not been drained. Most of the areas have been drained, however, and depth to the water table in these areas is 40 to 60 inches or more. Faint mottles are at a depth of 14 to 16 inches, and distinct or faint mottles are at a depth below 29 inches. They range from few to many. These soils are slightly affected by salts and alkali.

In the A1 horizon, value is 2 to 3 when the soils are moist; chroma is 2 or 3. Texture is fine sandy loam or heavy fine sandy loam. The A1 horizon is slightly to moderately calcareous and is 14 to 15 inches thick.

In the C horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is light loam, fine sandy loam, or loamy fine sand. Reaction is moderately alkaline to strongly alkaline.

Lewiston fine sandy loam (Ls).—This soil is on low lake terraces, lake plains, and river flood plains in the vicinity of Corinne. Slopes are 0 to 1 percent. Most areas of this soil have been leveled and tile drained. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate where the soil is left unprotected.

Included with this soil in mapping are small areas of Fridlo silt loam, moderately alkali, and Warm Springs fine sandy loam.

This Lewiston soil is used for irrigated tomatoes, sugar beets, corn for silage, alfalfa, small grains, and irrigated pasture. Capability unit IIw-2, irrigated; range site not assigned.

Logan Series

The Logan series consists of poorly drained soils. These soils are on low lake terraces, stream flood plains, and lake plains along the Bear River and along the edge of Great Salt Lake. They formed in alluvium and mixed lake sediments. Slopes range from 0 to 3 percent. Vegetation consists of wiregrass, sedges, bluegrass, foxtail, and saltgrass. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 110 to 150 days. Elevations range from 4,205 to 4,300 feet.

In a representative profile, the surface layer is dark-gray silty clay loam about 11 inches thick. The next layer is light-gray and white silty clay loam about 36 inches thick. Below this, and extending to a depth of about 60 inches, is mixed pinkish-gray and white silty clay loam. The surface layer is strongly alkaline and slightly calcareous, and the underlying layers are moderately alkaline and very strongly calcareous.

Permeability is slow, and the rate of water intake is slow. Depth of rooting is limited by the water table. Where the soils are drained, roots may penetrate to a depth of 60 inches or more.

Logan soils are used for range and wildlife habitat.

Representative profile of Logan silty clay loam, in range, 650 feet north and 100 feet west of the north quarter corner of section 26, T. 9 N., R. 2 W., southwest of Brigham City:

A1—0 to 11 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak, medium, granular structure; very hard, firm, slightly sticky and plastic; many very fine, fine, and medium roots; slightly calcareous; strongly alkaline (pH 8.6); gradual, wavy boundary.

C1cag—11 to 23 inches, light-gray (10YR 6/1) silty clay loam, light gray (10YR 6/1) when moist; weak, fine, subangular blocky structure; hard, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

C2cag—23 to 47 inches, white (10YR 8/1) heavy silty clay loam, light gray (10YR 7/1) when moist; common, coarse, distinct, reddish-yellow (7.5YR 6/8) mottles; massive; extremely hard, very firm, sticky and very plastic; common fine and medium roots; many fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); diffuse, irregular boundary.

C3—47 to 60 inches, 50 percent pinkish-gray (7.5YR 6/2) and 50 percent white (10YR 8/1) heavy silty clay loam, pinkish gray (7.5YR 6/2) and light gray (10YR 7/1), respectively, when moist; many, medium, distinct, yellowish-red (5YR 5/6) mottles; stratified lake sediments; extremely hard, very firm, sticky and very plastic; few fine and medium roots; many fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2).

Depth to the horizon of calcium carbonate accumulation ranges from 10 to 15 inches. Between depths of 10 and 40 inches, the texture averages silty clay loam or heavy silt loam and the content of clay ranges from 27 to 35 percent. The soils are usually moist and are saturated throughout for many weeks in winter and spring. The water table is normally between depths of 15 and 36 inches but is at or near the surface for many weeks in winter and spring. These soils are generally free of salts and alkali, but in the area near the Great Salt Lake, they are moderately to strongly affected by salts and alkali.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. This horizon is mainly silty clay loam but ranges to heavy silt loam, and it ranges from 10 to 15 inches in thickness.

In the Cca horizon, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist. Thickness ranges from 26 to 36 inches. In Cg horizon, hue ranges from 7.5YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma is 1 or 2. The horizons are mainly mixed lake sediments. Texture is silty clay loam or heavy silt loam stratified with layers of fine sandy loam that are 1/8 to 2 inches thick.

In this survey area the moderately saline phase of the Logan series is mapped as the smaller component of the Saltair-Logan association. A description of this association is given under the heading "Saltair series."

Logan silty clay loam (Lt).—This soil is on low lake terraces and stream flood plains. Slopes are 0 to 3 percent. Elevations range from 4,220 to 4,300 feet, and the frost-free period is 130 to 150 days. Runoff is very slow, and the hazard of erosion is none to slight. This soil is free of harmful salts and alkali. Available water holding capacity is 11 to 12 inches to a depth of 5 feet.

Included with this soil in mapping are small areas of Roshe Springs silt loam, Cudahy silt loam, and Airport silt loam.

This Logan soil is used mainly for range. It also has value as wildlife habitat. Native hay has been harvested in a few areas. Where the soil is drained and irrigated, alfalfa, small grains, corn for silage, sugar beets, and improved pastures are grown. Capability unit IIIw-25, irrigated; Wet Meadow range site.

Lucky Star Series

The Lucky Star series consists of well-drained soils. These soils are on north-facing mountains south of Mantua. They formed in residuum and colluvium derived from sandstone, quartzite, and conglomerate. Slopes range from 25 to 40 percent. The vegetation is an overstory of aspen and an understory of chokecherry, bearded wheatgrass, western coneflower, goldenrod, and mountain brome. Mean annual air temperature ranges from 37° to 41° F. Average annual precipitation ranges from 22 to 28 inches, and the frost-free period is 70 to 80 days. Elevations range from 6,500 to 7,500 feet.

In a representative profile, the surface layer is very dark gray silt loam about 20 inches thick. The subsurface layer is brown gravelly loam about 13 inches thick. The subsoil is brown gravelly clay loam that extends to a depth of 50 inches. The next layer is brown very gravelly loam and extends to a depth of more than 60 inches. These soils are slightly acid to a depth of 50 inches and are medium acid below that depth.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 7 to 9 inches to a depth of 5 feet. The water-supplying capacity is 13 to 19 inches before moisture is depleted. Roots of aspen penetrate to a depth of more than 60 inches.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Lucky Star loam, 25 to 40 percent slopes, in an area of Lucky Star-Elzinga association, steep, in range, 1,150 feet west and 500 feet north of the southeast corner of section 10, T. 8 N., R. 1 W., south of Mantua:

O1—1 inch to 0, matted decaying leaves and twigs.

A11—0 to 11 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; 18 percent gravel; slightly acid (pH 6.3); clear, smooth boundary.

A12—11 to 20 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, medium and fine, subangular blocky structure that parts to weak, fine, granular; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; 18 percent gravel; slightly acid (pH 6.3); clear, wavy boundary.

A2—20 to 33 inches, brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine and fine pores; 40 percent gravel and cobblestones; slightly acid (pH 6.2); gradual, irregular boundary.

B21t—33 to 40 inches, brown (7.5YR 5/4) gravelly clay loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine and very fine roots; common very fine and fine pores; common thin clay films on ped faces; 35 percent gravel; slightly acid (pH 6.1); diffuse, irregular boundary.

B22t—40 to 50 inches, brown (7.5YR 5/4) gravelly clay loam, brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; extremely hard, firm, very sticky and very plastic; few fine and very fine roots; many very fine and fine pores; many thin clay films on ped faces; 30 percent gravel; slightly acid (pH 6.1); gradual, wavy boundary.

B3—50 to 60 inches, brown (7.5YR 5/4) very gravelly heavy loam, brown (7.5YR 4/4) when moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and very fine pores; few thin clay films on ped faces; 65 percent gravel; medium acid (pH 6.0).

The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer in most years.

In the A1 horizon, value is 3 or 4 when the soils are dry and chroma is 1 or 2. This horizon is silt loam or gravelly loam that is 15 to 20 percent gravel, and it ranges from 18 to 20 inches in thickness. In the A2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry; and chroma ranges from 2 to 4. This horizon is gravelly loam or cobbly loam that is 30 to 40 percent gravel and cobblestones, and it ranges 12 to 14 inches thick.

In the B2t horizon, hue is 7.5YR or 5YR. Texture is gravelly clay loam or cobbly clay loam that is 30 to 50 percent gravel and cobblestones. Clay films range from few to many on ped faces. Below the B2t horizon, the soil material is very gravelly and cobbly material to soft, weathered sandstone.

Lucky Star-Elzinga association, steep (LUE).—This mapping unit is on the mountains south of Mantua and west of Devils Gate Valley. It consists of about 40 percent Lucky Star silt loam, 25 to 40 percent slopes, and 40 percent Elzinga silt loam, 25 to 50 percent slopes. Included with these soils in mapping are areas of Goring clay loam, 25 to 40 percent slopes; Maughan silt loam, 25 to 50 percent slopes; Yeates Hollow stony loam, 25 to 40 percent slopes; and a deep soil that has a clay loam subsoil and is under a cover of oakbrush. These included soils make up about 20 percent of the total acreage.

The soils of this association are intermingled on broad, east-facing, stream-dissected side slopes of mountain valleys. The Lucky Star soil is on short, north-facing slopes along the stream channels under aspen trees. The Elzinga soil is on east-facing, even, and slightly concave ridges under maple trees.

Runoff is medium on these soils and the hazard of erosion is moderate.

The soils of this association are used for range, wildlife habitat, and water supply. The Lucky Star soil is in capability unit VIe-H, nonirrigated; High Mountain Loam (Aspen) range site. The Elzinga soil is in capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site.

Magna Series

The Magna series consists of poorly drained soils. These soils are on low lake terraces and lake plains in the western part of Bear River valley near Penrose. They formed in calcareous, fine textured and moderately fine textured, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is Great Basin wildrye, saltgrass, foxtail, western wheatgrass, greasewood, and alkali sacaton. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 135 to 145 days. Elevations range from 4,250 to 4,300 feet.

In a representative profile, the surface layer is silty clay loam about 13 inches thick; it is grayish brown in the upper part and light brownish gray in the lower part. The underlying layers, extending to a depth of about 60 inches, are light-gray and white silty clay in the upper part and pinkish-gray and pink silty clay loam and silty clay in the lower part. The surface layer is slightly calcareous and moderately alkaline. A layer of strong lime accumulation is at a depth of 13 inches. Between depths of 13 inches and 60 inches, these soils are strongly calcareous or very strongly calcareous and strongly alkaline.

Permeability is slow, and rate of water intake is slow. The water-holding capacity is 11 to 12 inches to a depth of 5 feet, but the water available to plants is only about 9 to 10 inches because of the content of salt. Roots are mainly above the water table, but where the soils are drained, roots may extend to a depth of more than 60 inches.

Magna soils are used for irrigated crops and wet meadow pasture.

Representative profile of Magna silty clay loam, in a cultivated field, 2,050 feet west and 1,400 feet south of the northeast corner of section 23, T. 11 N., R. 4 W., about 1½ miles southeast of Thatcher church:

Ap—0 to 7 inches, grayish-brown (2.5Y 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, coarse, granular structure; hard, friable, sticky and plastic; few fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

A1—7 to 13 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

C1ca—13 to 19 inches, light-gray (2.5Y 7/2) silty clay, olive gray (5Y 5/2) when moist; weak, medium, subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine and very fine roots; many krotovinas ⅜ to ¾ inch in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, irregular boundary.

C2ca—19 to 30 inches, white (5Y 8/2) silty clay, light olive gray (5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, prismatic structure that parts to moderate, medium, angular and subangular blocky; extremely hard, very firm, very sticky and very plastic; few fine and very fine roots; organic stain, very dark grayish brown (2.5Y 3/2) when moist, on prism faces; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); abrupt, irregular boundary.

C3cag—30 to 37 inches, white (5Y 8/1) silty clay, light olive gray (5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; extremely hard, extremely firm, sticky and very plastic; organic stain of very dark grayish brown (2.5Y 3/2) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

C4—37 to 46 inches, pinkish-gray (7.5YR 7/2) heavy silty clay loam, brown (7.5YR 5/2) when moist; massive (stratified lake sediments); very hard, very firm, sticky and plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, wavy boundary.

C5—46 to 60 inches, pink (7.5YR 7/4) light silty clay, brown (7.5YR 5/4) when moist; massive (stratified lake sediments); very hard, very firm, sticky and very plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation is 12 to 13 inches. Between depths of 10 and 40 inches, the texture averages silty clay and the content of clay ranges from 35 to 42 percent. Most of the acreage has been drained, and depth to the water table is about 30 to 60 inches. Where the soils are not drained, the depth to the water table is about 18 to 30 inches. These soils are slightly affected by salts and alkali. Distinct mottles are at depths below 19 inches and range from few to many.

In the A1 horizon, hue ranges from 10YR to 5Y; value is 5 or 6 when the soils are dry; and chroma is 1 or 2. This horizon is heavy silty clay loam or light silty clay loam, and it ranges from 12 to 13 inches in thickness. It is moderately alkaline to strongly alkaline.

In the C horizon, hue ranges from 7.5YR to 5Y; value ranges from 6 to 8 when the soils are dry and is 5 or 6 when they are moist; and chroma is generally 1 or 2 but may be 4 in some layers. This horizon is moderately alkaline to strongly alkaline and strongly calcareous or very strongly calcareous. Stratified lake sediments begin at a depth of 30 to 47 inches. These sediments are mainly silty clay loam or silty clay but include layers of very fine sandy loam ⅛ inch to 2 inches thick.

Magna silty clay loam (Ma).—This soil is on broad, low lake terraces and lake plains in the extreme western part of Bear River valley near Penrose. Slopes are 0 to

1 percent. Runoff is slow, and the hazard of erosion is none to slight.

Included with this soil in mapping are small areas of Collett silty clay loam; Greenson silt loam, strongly alkali; and Stokes silt loam.

This soil is used for irrigated sugar beets, corn for silage, irrigated pasture, small grains, alfalfa, and wet meadow pastures. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Manila Series

The Manila series consists of well-drained soils. These soils are on mountain slopes and high lake terraces in the vicinity of Mantua and on the mountains between Blue Creek valley and the Malad River valley. They formed in colluvium, residuum, and alluvium derived mainly from sandstone, limestone, and quartzite. Slopes range from 6 to 60 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, big sagebrush, Great Basin wildrye, serviceberry, snowberry, annual grasses, and some bitterbrush. Mean annual air temperature ranges from 42° to 45° F. Average annual precipitation ranges from 16 to 21 inches, and the frost-free period is 85 to 100 days. Elevations range from 4,900 to 6,800 feet.

In a representative profile, the surface layer is dark grayish-brown loam about 13 inches thick. The subsoil is grayish-brown silty clay loam in the upper 7 inches, brown silty clay and light-brown clay in the next 12 inches, and grayish-brown silty clay in the lower 10 inches. The substratum is pale-brown very cobbly silt loam that extends to weathered sandstone and fractured limestone bedrock at a depth of 57 inches. The surface layer and upper part of the subsoil are mildly alkaline, the lower part of the subsoil is moderately alkaline, and the substratum is strongly alkaline and is strongly calcareous.

Permeability is slow, and the rate of water intake is moderate. Roots penetrate to the limestone and sandstone.

Manila soils are used mainly for range, nonirrigated crops, wildlife habitat, and water supply. Some areas are used for irrigated crops.

Representative profile of Manila loam, 25 to 60 percent slopes, in range, 2,300 feet north and 1,800 feet west of the southwest corner of section 35, T. 14 N., R. 5 W., about 4 miles northwest of Whites Valley:

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; few fine and very fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

A12—5 to 13 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few fine and very fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

B1—13 to 20 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; few fine and very fine pores; mildly alkaline (pH 7.6); gradual, wavy boundary.

B21t—20 to 25 inches, brown (10YR 5/3) silty clay, brown (7.5YR 4/4) when moist; moderate, medium, prismatic structure that parts to strong, medium, subangular blocky; very hard, very firm, very sticky and very plastic; few fine roots; few very fine pores; many moderately thick clay films on ped faces; mildly alkaline (pH 7.8); gradual, wavy boundary.

B22t—25 to 32 inches, light-brown (7.5YR 6/4) clay, brown (7.5YR 4/4) when moist; strong, medium or coarse, prismatic structure that parts to strong, medium or coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; continuous moderately thick clay films on ped faces; moderately alkaline (pH 8.0); gradual, wavy boundary.

B23t—32 to 42 inches, grayish-brown (10YR 5/2) silty clay, dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; extremely hard, very firm, very sticky and plastic; few very fine roots; few very fine pores; common thin clay films on ped faces; moderately alkaline (pH 8.2); diffuse, wavy boundary.

IIC1ca—42 to 57 inches, pale-brown (10YR 6/3) very cobbly silt loam, yellowish brown (10YR 5/4) when moist; massive; hard, firm, sticky and plastic; contains 50 percent cobblestones and gravel; strongly calcareous, lime is bedded; strongly alkaline (pH 8.6); abrupt, irregular boundary.

IICR—57 inches, weathered sandstone and fractured limestone.

The solum ranges from 40 to 60 inches or more in thickness. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in most summers. In the A1 horizon, value is 3 or 4 when the soils are dry. This horizon is loam or silt loam and ranges from 6 to 13 inches in thickness. It is slightly acid to moderately alkaline. The B1 horizon is 4 to 7 inches thick.

In the B2t horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when the soils are moist; and chroma is 2 to 4. The B2t horizon is clay or silty clay, and its content of gravel or cobblestones ranges from 0 to 20 percent. The horizon ranges from 22 to 50 inches in thickness. Clay films are common to continuous and thin to thick.

Below the B2t horizon are the B3, B3ca, C, or Cca horizons. Hue is 10YR or 7.5YR; value ranges from 5 to 7 when the soils are dry and from 4 to 7 when they are moist; and chroma is 3 or 4. These horizons are clay, silty clay, silty clay loam, clay loam, or silt loam and are noncobbly to very cobbly. They are mildly alkaline to strongly alkaline and noncalcareous to strongly calcareous. Depth to the parent rock (CR horizon) ranges from 50 to 60 inches or more.

Manila loam, 6 to 10 percent slopes (MbC).—This soil is on high lake terraces that have all aspects. The profile of this soil is similar to that described as representative for the Manila series, but the surface layer and subsoil combined are 5 or more feet thick and contain no gravel or cobblestones. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is about 11 to 13 inches to a depth of 5 feet. The water-supplying capacity is about 12 to 14 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Yeates Hollow cobbly clay loam, 20 to 30 percent slopes, and Goring clay loam, 10 to 25 percent slopes.

This soil is used for irrigated and nonirrigated alfalfa and small grains. Only a small acreage is irrigated. Capability unit IIIe-M, nonirrigated; range site not assigned.

Manila loam, 10 to 25 percent slopes (MbE).—This soil is on high lake terraces having all aspects and on north- and east-facing mountain slopes. Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is about 12 to 16 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Yeates Hollow cobbly clay loam, 20 to 30 percent slopes; Broad cobbly loam, 20 to 30 percent slopes; Forsgren silt

loam, 10 to 20 percent slopes; and Middle cobbly silt loam, 10 to 30 percent slopes.

This soil is used mainly for range. It also is used for nonirrigated small grains and alfalfa and for wildlife habitat and water supply. Capability unit IVe–M, nonirrigated; Mountain Loam range site.

Manila loam, 25 to 60 percent slopes (MCG).—This soil is on north- and east-facing mountain slopes. A profile of this soil is the one described as representative for the Manila series. Runoff is rapid, and the hazard of erosion is high. Available water holding capacity is about 11 to 12 inches. The water-supplying capacity is about 16 to 18 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Broad cobbly loam, 30 to 60 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes.

This soil is used mainly fo range. It also is used for wildlife habitat and water supply. Capability unit VIIe–M, nonirrigated; Mountain Loam range site.

Manila-Smarts association, steep (MDG).—This mapping unit is on mountain slopes. It consists of about 60 percent Manila loam, 25 to 60 percent slopes, and 30 percent Smarts loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Broad cobbly loam, 30 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

The Manila soil is on very steep, north- and east-facing mountain slopes under a cover of bluebunch wheatgrass, big sagebrush, Great Basin wildrye, snowberry, and yellowbrush. The Smarts soil is in very steep, north- and east-facing ravines and canyons under a cover of maple, scrub aspen, and shrubs.

Runoff is rapid on the Manila soil, and the hazard of erosion is high. Available water holding capacity is about 11 to 12 inches. The water-supplying capacity is about 16 to 18 inches for plant growth before moisture is depleted.

This association is used for range, habitat for big-game animals, and water supply. Manila loam is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Smarts loam is in capability unit VIIe–M, nonirrigated; Mountain Loam (Shrub) range site.

Martini Series

The Martini series consists of moderately well drained soils. These soils are on low river terraces and flood plains along the Bear River in the east-central part of the survey area. They formed in mixed, moderately coarse textured, stratified alluvium derived mainly from limestone, sandstone, and quartzite. Slopes range from 0 to 2 percent. The vegetation in noncultivated areas is mainly boxelder, willow, rose, western wheatgrass, Great Basin wildrye, sagebrush, and cheatgrass. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 125 to 145 days. Elevations range from 4,215 to 4,315 feet.

In a representative profile, the surface layer is grayish-brown fine sandy loam about 9 inches thick. The underlying layers, reaching to a depth of 60 inches or more, are stratified materials; they are brown and light brownish-gray very fine sandy loam, light brownish-gray fine sandy loam, light brownish-gray sandy loam, grayish-brown very fine sandy loam, and light brownish-gray loam. These soils are moderately calcareous to a depth of 22 inches and strongly calcareous between depths of 22 inches and 60 inches or more. They are mostly moderately alkaline throughout.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is 8.5 to 10.5 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

Martini soils are used for irrigated and nonirrigated crops and range.

Representative profile of Martini fine sandy loam, in a cultivated field, 1,100 feet north and 1,750 feet west of the southeast corner of section 18, T. 12 N., R. 2 W., along the Bear River about 1 mile west of Collinston:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; single grained; loose; common fine and medium roots; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

C1—9 to 15 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable; few fine roots; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.

C2—15 to 22 inches, light brownish-gray (10YR 6/2) very fine sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable; few fine roots; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.

C3—22 to 30 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark brown (10YR 3/3) when moist; single grained; loose; few fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.

C4—30 to 45 inches, light brownish-gray (10YR 6/2) sandy loam, brown (10YR 4/3) when moist; single grained; loose; few fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); abrupt, smooth boundary.

A1b—45 to 52 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, irregular boundary.

C5—52 to 63 inches, light brownish-gray (10YR 6/2) loam, dark grayish-brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Between depths of 10 and 40 inches, the texture averages fine sandy loam and content of clay ranges from 10 to 15 percent. The 10- to 40-inch depth is stratified with thin layers of loam or loamy fine sand. The soils are usually moist, but in most years they are dry in all parts between depths of 8 and 24 inches for more than 60 consecutive days in summer. Distinct mottles may be at depths below 30 to 48 inches and range from few to common and from fine to medium. Depth to the water table ranges from 36 to 48 inches. In places these soils are slightly to moderately affected by salts and alkali.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. This horizon is fine sandy loam or light loam, and it ranges from 9 to 18 inches in thickness. A dark-colored, buried A1 horizon is at depths between 20 and 60 inches. Content of organic matter decreases irregularly with depth.

In the C horizon, value ranges from 5 to 7 when the soils are dry and from 3 to 5 when they are moist; chroma is 2 or 3. The C horizon is moderately calcareous to strongly calcareous and moderately alkaline to very strongly alkaline.

Martini fine sandy loam (Me).—This soil is on low river terraces and flood plains, mainly as small parcels on

the oxbows along the Bear River from Fielding to Corinne. Slopes are 0 to 2 percent. The surface is quite uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight. This soil is subject to overflow or flooding early in spring in about 4 years out of 10.

Included with this soil in mapping are small areas of Kirkham silt loam and Sunset silt loam and small areas that are slightly to moderately affected by salt and alkali.

This soil is used mainly for irrigated crops. Some areas are used for nonirrigated small grains and for range. Irrigated crops are alfalfa, sugar beets, small grains, corn for silage, and improved pasture. Irrigation is mainly by direct diversion or pumping from the Bear River. Capability unit IIw–2, irrigated; Semiwet Meadow range site.

Maughan Series

The Maughan series consists of well-drained soils. These soils are on north-facing mountains near Mantua. They formed in colluvium and alluvium derived from sandstone and quartzite. Slopes range from 25 to 50 percent. The vegetation is a dense overstory of maple and oregongrape and an understory of bearded wheatgrass. Mean annual air temperature ranges from 38° to 43° F. Average annual precipitation ranges from 20 to 26 inches, and the frost-free period is 70 to 100 days. Elevations range from 5,200 to 7,500 feet.

In a representative profile, the surface layer is dark-gray silt loam about 24 inches thick. The subsurface layer is brown very cobbly loam about 11 inches thick. The subsoil, extending to a depth of 60 inches or more, is reddish-brown cobbly clay in the upper part and reddish-brown cobbly silty clay in the lower part. The soils are slightly acid to medium acid.

Permeability is moderate to a depth of 35 inches and is slow below that depth. The rate of water intake is slow. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 14 to 21 inches before moisture is depleted. Roots penetrate to a depth of more than 60 inches.

These soils are used for range and wildlife habitat.

Representative profile of Maughan silt loam, 25 to 50 percent slopes, in an area of Elzinga-Maughan complex, 25 to 50 percent slopes, in range, 1,400 feet east and 100 feet north of the west quarter corner of section 16, T. 9 N., R. 1 W., northwest of Mantua:

O1—3 inches to 0, matted, decaying leaves and twigs.

A1—0 to 24 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and coarse roots; 15 percent cobblestones; slightly acid (pH 6.4); clear, wavy boundary.

A2—24 to 35 inches, brown (10YR 5/3) very cobbly loam, brown (7.5YR 4/2) when moist; weak, medium and fine, subangular blocky structure; soft, friable, nonsticky and slightly plastic; common very fine and coarse roots; 55 percent cobblestones; slightly acid (pH 6.2); gradual, irregular boundary.

B21t—35 to 51 inches, reddish-brown (5YR 5/4) cobbly clay, dark brown (7.5YR 4/4) when moist; moderate, medium, prismatic structure that parts to strong, medium and coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine and coarse roots; few very fine pores; many moderately thick clay films on ped faces; 20 percent cobblestones; many small (about 1 millimeter in diameter) manganese concretions; medium acid (pH 6.0); diffuse, irregular boundary.

B22t—51 to 66 inches, reddish-brown (5YR 5/4) cobbly silty clay, dark brown (7.5YR 4/4) when moist; moderate, medium and coarse, subangular blocky structure; extremely hard, firm, very sticky and very plastic; few fine and very fine roots; few fine and very fine pores; common moderately thick clay films on ped faces; 35 percent weathered sandstone cobblestones, surrounded by silt loam material; medium acid (pH 6.0).

The solum ranges from 54 to 70 inches or more in thickness. Content of coarse fragments, mostly cobblestones, ranges from 10 to 15 percent in the A1 horizon, 20 to 55 percent in the A2 horizon, and 20 to 35 percent in the B2t horizon. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer in most years.

In the A1 horizon, value is 3 or 4 when the soils are dry; chroma is 1 or 2. This horizon ranges from 24 to 26 inches in thickness. In the A2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. This horizon is cobbly heavy loam or very cobbly loam, and it ranges from 9 to 14 inches thick.

In the B2t horizon, hue is 7.5YR or 5YR; value is 4 or 5 when the soils are dry and is 3 or 4 when they are moist. Texture is cobbly clay or cobbly silty clay, and reaction is slightly acid or medium acid.

In this survey area the Maughan soils are mapped only in a complex with the Elzinga soils. A description of this complex is given under the heading "Elzinga Series."

Mellor Series

The Mellor series consists of well-drained soils that are affected by alkali. These soils are on low lake terraces in Curlew Valley and Hansel Valley. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes range from 1 to 6 percent but most commonly are 1 to 3 percent. The vegetation consists of shadscale, greasewood, squirreltail, kochia, annual mustard, and cheatgrass. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,260 to 4,600 feet.

In a representative profile, the surface layer is pale-brown and very pale brown silt loam about 6 inches thick. The subsoil is about 12 inches thick. It is light brownish-gray and light-gray silty clay loam in the upper part and light-gray silt loam in the lower part. The substratum, to a depth of 48 inches, is light-gray silt loam. Between depths of 48 and 62 inches the substratum is light-gray gravelly loamy fine sand. These soils are moderately calcareous to strongly calcareous and mostly strongly alkaline throughout.

Permeability is slow, and the rate of water intake is slow. Because of the salt content, the water available to plants is only 3 to 7 inches to a depth of 5 feet and the water-supplying capacity is about 5.5 to 8 inches before moisture is depleted. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of more than 60 inches, but most roots are in the top 18 inches of soil.

These soils are used for range.

Representative profile of Mellor silt loam, 1 to 6 percent slopes, in range, 2,900 feet north and 2,200 feet east of the southwest corner of section 16, T. 12 N., R. 7 W., about one-fourth mile north of Salt Wells in south Hansel Valley:

A11—0 to 3 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (2.5Y 4/2) when moist; moderate,

thick, platy structure that parts to moderate, thin, platy; soft, friable, nonsticky and slightly plastic; common fine and very fine and few medium roots; common very fine and few fine pores; moderately calcareous; strongly alkaline (pH 8.7); abrupt, smooth boundary.

A12—3 to 6 inches, very pale brown (10YR 7/3) silt loam, dark grayish brown (10YR 4/2) when moist; strong, thick, platy structure that parts to moderate, thin, platy; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; few fine pores; moderately calcareous; strongly alkaline (pH 8.7); abrupt, smooth boundary.

B21t—6 to 10 inches, light brownish-gray (2.5YR 6/2) light silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure that parts to moderate, fine, subangular blocky; hard, firm, sticky and slightly plastic; common very fine and few medium roots; common very fine and fine pores; many thin clay films on ped faces; moderately calcareous; strongly alkaline (pH 8.7); clear, smooth boundary.

B22t—10 to 14 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky and slightly plastic; common fine and very fine and few medium roots; common very fine pores; continuous thin and common moderately thick clay films on ped faces; few krotovinas (2 to 5 millimeters in diameter); strongly calcareous; strongly alkaline (pH 8.9); clear, wavy boundary.

B3tca—14 to 18 inches, light-gray (10YR 5/2) heavy silt loam, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; common fine and very fine and few medium roots; few very fine pores; few thin clay films on ped faces; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.

C1ca—18 to 25 inches, light-gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, wavy boundary.

C2—25 to 41 inches, light-gray (2.5Y 7/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, sticky and slightly plastic; few fine and very fine roots; many fine pores; some thin gypsum seams; 1 percent fine gravel; strongly calcareous, lime is filamentary; strongly alkaline (pH 8.9); abrupt, smooth boundary.

C3—41 to 48 inches, light-gray (5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); abrupt, smooth boundary.

IIC4—48 to 62 inches, light-gray (10YR 7/2) gravelly loamy fine sand, pale brown (10YR 6/3) when moist; single grained; strongly calcareous, lime is disseminated; loose, except weakly cemented between depths of 48 and 49 inches; strongly alkaline (pH 8.5).

The surface has a prominent polygonal pattern. Depth to the horizon of carbonate accumulation ranges from 11 to 21 inches. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, value is 6 to 7 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. Reaction is moderately alkaline to very strongly alkaline. Thickness of the A1 horizon ranges from 4 to 8 inches.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is light silty clay loam or silty clay loam, and content of clay ranges from 28 to 35 percent. Clay films range from few to many and from thin to moderately thick on ped faces. This horizon is strongly alkaline to very strongly alkaline and is moderately calcareous to strongly calcareous. The B3ca horizon, where present, is similar to the B2t horizon in color, texture, and reaction, but it is strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value is 7 or 8 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is mainly silt loam but may be light silty clay loam or very fine sandy loam. This horizon is moderately to strongly affected by salts and alkali.

Mellor silt loam, 1 to 6 percent slopes (MFB).—This soil is on low lake terraces. Slopes are slightly convex and medium in length and most commonly are 1 to 3 percent. A profile of this soil is the one described as representative for the Mellor series. Runoff is medium, and the hazard of erosion is moderate. Shallow gullies have been formed in places.

Included with this soil in mapping are small areas of Bram silt loam; Harding silt loam; Palisade silt loam, 1 to 6 percent slopes; and Thiokol silt loam, low rainfall, 1 to 3 percent slopes.

This soil is used for range. Capability unit VIIs–S8, nonirrigated; Semidesert Alkali Flats range site.

Mellor-Thiokol silt loams, 1 to 6 percent slopes (MGB).—This mapping unit is on low lake terraces. Slopes are slightly convex and medium in length. The mapping unit consists of about 60 percent Mellor silt loam, 1 to 6 percent slopes, and 35 percent Thiokol silt loam, low rainfall, 1 to 6 percent slopes. Included with these soils in mapping are areas of Bram silt loam and Saxby extremely stony silt loam, 1 to 6 percent slopes. These included soils make up about 5 percent of the total acreage.

Soils of this complex are intermingled. The Mellor soil is in slightly convex, undulating areas under a cover of kochia, halogeton, annual mustard, and some shadscale. The Thiokol soil is in slightly raised positions along the shallow drainageways and supports a cover of sagebrush and squirreltail.

The profile of the Mellor soil in this complex is similar to that described as representative for the Mellor series. The Thiokol soil in this complex is similar to Thiokol silt loam, 1 to 6 percent slopes, but the frost-free period is 90 to 110 days and the average annual precipitation is 8 to 11 inches. Runoff is medium, and the hazard of erosion is moderate.

The soils of this complex are used mainly for range, but a very small area in Curlew Valley is used for irrigated small grains and alfalfa. Capability unit VIIs–S8, nonirrigated; Semidesert Alkali Flats range site.

Mendon Series

The Mendon series consists of well-drained soils. These soils are on intermediate and high lake terraces in the northeastern part of the survey area. They formed in alluvium and lake sediments derived from light-colored tufaceous sandstone, conglomerate, and limestone. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas is mainly bluebunch wheatgrass, western wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,700 to 5,100 feet.

In a representative profile (fig. 9), the surface layer is dark-gray silt loam about 12 inches thick. The subsoil is grayish-brown silty clay loam about 19 inches thick. The substratum is white silt loam that reaches to a depth

Figure 9.—**Profile of Mendon silt loam, 1 to 6 percent slopes.**

of 60 inches or more. The surface layer and subsoil are mildly alkaline. The substratum is strongly alkaline and strongly calcareous. A layer of strong lime accumulation is at a depth of about 31 inches.

Permeability is moderately slow to a depth of 31 inches but is moderate below that depth, and the rate of water intake is moderate. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is 14 to 16 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for nonirrigated crops.

Representative profile of Mendon silt loam, 1 to 6 percent slopes, in a nonirrigated crop area, 400 feet west of the southeast corner of section 15, T. 15 N., R. 2 W.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, medium and fine, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; mildly alkaline (pH 7.4); clear, smooth boundary.

A1—7 to 12 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine and very fine roots; common fine pores; mildly alkaline (pH 7.5); clear, smooth boundary.

B21t—12 to 23 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to strong, medium, subangular blocky; very hard, firm, sticky and plastic; common fine and few medium roots; common very fine and fine pores; continuous moderately thick clay films on ped faces; mildly alkaline (pH 7.6); clear, wavy boundary.

B22t—23 to 31 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to strong, medium, subangular blocky; very hard, firm, sticky and very plastic; many fine and very fine and few medium roots; common fine and few medium pores; continous moderately thick clay films on ped faces; mildly alkaline (pH 7.6); abrupt, smooth boundary.

C1ca—31 to 42 inches, white (10YR 8/1) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; strongly calcareous, lime is disseminated: strongly alkaline (pH 8.7); clear, wavy boundary.

C2—42 to 62 inches, white (5Y 8/1) light silt loam, light olive gray (5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine and very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7).

The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 1 to 1.5 in the upper part and ranges to 2 in the lower part. Thickness of the A1 horizon ranges from 10 to 13 inches.

In the B2t horizon, hue is 10YR to 5Y; value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; and chroma is 1 or 2. Texture is silty clay loam or heavy silt loam. Clay films are thin to moderately thick and few to continuous on ped faces. Reaction is mildly alkaline or moderately alkaline.

In the C horizon, hue is 10YR, 2.5Y, or 5Y; value is 7 or 8 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 1 or 2. Depth to the Cca horizon is most commonly 30 inches but may be as much as 40 inches. Texture in the C horizon is silt loam, silty clay loam, or silty clay. Reaction is mildly alkaline to strongly alkaline.

Mendon silt loam, 1 to 6 percent slopes (MhB).—This soil is on lake terraces in the northeastern part of the survey area near Plymouth and Collinston. Slopes are medium in length. A profile of this soil is the one described as representative for the Mendon series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Anty fine sandy loam, 1 to 6 percent slopes; Collinston silt loam, 6 to 10 percent slopes; and Mendon silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIe–M, nonirrigated; range site not assigned.

Mendon silt loam, 6 to 10 percent slopes (MhD).—This soil is on lake terraces in the northeastern part of the survey area between Plymouth and Collinston. Slopes are short and slightly convex. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Anty fine sandy loam, 6 to 10 percent slopes; Collinston silt loam, 6 to 10 percent slopes; and Mendon silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe–M, nonirrigated; range site not assigned.

Middle Series

The Middle series consists of well-drained soils on mountains. These soils formed in residuum and colluvium derived mainly from sandstone, limestone, quartzite, and basalt. A small area of this soil that formed in basaltic material is near Rattlesnake Pass. Slopes range from 10 to 70 percent. Vegetation is mainly bluebunch wheatgrass, sagebrush, bitterbrush, and cheatgrass. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 15 to 18 inches, and the frost-free period is 100 to 110 days. Elevations range from 4,800 to 6,600 feet.

In a representative profile, the surface layer is grayish-brown and brown cobbly silt loam about 7 inches thick. The subsoil is brown cobbly silt loam and very cobbly silt loam about 12 inches thick. The substratum is very pale brown very cobbly loam about 9 inches thick over limestone bedrock, which is at a depth of about 28 inches. The surface layer is mildly alkaline, the subsoil is moderately alkaline, and the substratum is moderately alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 2.5 to 4 inches above bedrock. The water-supplying capacity is about 8 or 9 inches before moisture is depleted. Roots are concentrated in the top 24 to 30 inches but can penetrate to bedrock.

Middle soils are used for range and wildlife habitat.

Representative profile of Middle cobbly silt loam, 30 to 70 percent slopes, in range, 2,400 feet east and 1,200 feet north of the southwest corner of section 16, T. 14 N., R. 4 W., about 4 miles southwest of Portage in Rough Canyon:

A11—0 to 3 inches, grayish-brown (10YR 5/2) cobbly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; common very fine pores; 30 percent cobblestones and gravel; mildly alkaline (pH 7.8); clear, smooth boundary.

A12—3 to 7 inches, brown (10YR 5/3) cobbly silt loam, dark brown (10YR 3/3) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; common very fine pores; 35 percent cobblestones and gravel; mildly alkaline (pH 7.8); clear, smooth boundary.

B21—7 to 12 inches, brown (10YR 5/3) cobbly silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; 45 percent cobblestones and gravel; moderately alkaline (pH 8.0); gradual, wavy boundary.

B22—12 to 19 inches, brown (10YR 5/3) very cobbly heavy silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many fine pores; 55 percent cobblestones and gravel; slightly calcareous; moderately alkaline (pH 8.0); gradual, wavy boundary.

Cca—19 to 28 inches, very pale brown (10YR 7/4) very cobbly loam, yellowish brown (10YR 5/4) when moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; 80 percent cobblestones and gravel, and also a few stones; strongly calcareous; moderately alkaline (pH 8.2); abrupt, irregular boundary.

R—28 to 32 inches, fractured limestone bedrock.

The solum ranges from 13 to 24 inches in thickness. Depth to bedrock ranges from 24 to 38 inches. Coarse fragments are angular cobblestones and gravel. Their content ranges from 25 to 50 percent in the A1 horizon and from 25 to 80 percent in the B2 and C horizons. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. This horizon is cobbly silt loam or gravelly loam and ranges from 5 to 17 inches in thickness. Reaction is mildly alkaline or moderately alkaline.

In the B2 horizon, value ranges from 5 to 7 when the soils are dry and is 4 or 5 when they are moist; and chroma is 2 or 3. Texture is gravelly, very gravelly, cobbly, or very cobbly silt loam, silty clay loam, or clay loam. The B2 horizon is mildly alkaline to moderately alkaline, is nonclacareous to moderately calcareous, and is 5 to 12 inches thick.

In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 3 to 5 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly light loam or very cobbly heavy loam. Reaction is moderately alkaline to strongly alkaline.

Middle cobbly silt loam, 10 to 30 percent slopes (MIE).—This soil is mainly on north-facing mountain slopes. Elevations range from 5,300 to 5,800 feet. Runoff is medium, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Broad cobbly loam, 20 to 30 percent slopes, and Middle cobbly silt loam, 30 to 70 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIe–U, nonirrigated; Upland Loam range site.

Middle cobbly silt loam, 30 to 70 percent slopes (MIG).—This soil is mainly on north-facing mountain slopes. A profile of this soil is the one described as representative for the Middle series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Broad cobbly loam, 30 to 60 percent slopes, and Smarts loam, 30 to 70 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIIe–U, nonirrigated; Upland Loam range site.

Middle-Broad association, steep (MJG).—This mapping unit is on the mountains surrounding Blue Creek valley and Howell Valley. It consists of about 65 percent Middle cobbly silt loam, 30 to 70 percent slopes, and 25 percent Broad cobbly loam, 30 to 60 percent slopes. Included with these soils in mapping are areas of Yeates Hollow cobbly clay loam, 30 to 60 percent slopes; Richmond very stony loam, 30 to 70 percent slopes; and Smarts loam, 30 to 70 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this association are intermingled. The Middle soil is on slightly concave, south- and west-facing mountain slopes. The Broad soil is on even or slightly concave, north- and east-facing mountain slopes. (fig. 10). Both soils have a cover of bluebunch wheatgrass, sagebrush, bitterbrush, yellowbrush, and annual grasses.

The profile of the Middle soil in this association is similar to that described as representative for the Middle series, but the surface layer ranges from 5 to 9 inches in thickness. Elevations range from 5,300 to 6,400 feet. Runoff is medium, and the hazard of erosion is moderate. The profile of the Broad soil is similar to that described as representative for the Broad series.

The soils in this association are used for range and wildlife habitat. The Middle soil is in capability unit VIIe–U, nonirrigated; Upland Loam range site. The Broad soil is in capability unit VIIs–M, nonirrigated; Mountain Stony Loam range site.

Middle-Rock outcrop complex, 10 to 30 percent slopes (MKE).—This mapping unit is on the mountains in the

***Figure 10.*—An area of Middle-Broad association, steep. The Middle soil is on the south-facing slopes where the snow has melted. The Broad soil is on the north-facing slopes that are covered by snow. Slopes are mainly 30 to 70 percent. The soil in the foreground is mainly Middle cobbly silt loam, 10 to 30 percent slopes.**

northern part of Hansel Valley. It consists of about 50 percent Middle cobbly loam, 10 to 30 percent slopes, and 30 percent Rock outcrop. Included with this unit in mapping are areas of Rock land; Sandall cobbly silt loam, 10 to 30 percent slopes; Gemson silty clay loam, 10 to 20 percent slopes; and Snowville gravelly silt loam, 6 to 20 percent slopes. These included areas make up about 20 percent of the total acreage.

This complex is mainly on south- and west-facing slopes. The Middle soil is on slightly concave side slopes. Its plant cover is mostly sagebrush and bluebunch wheatgrass, but there is some yellowbrush, bitterbrush, jupnier, and annual weeds and grass. Rock outcrop is mainly on ridgetops and knobs that are close enough together to hinder the movement of grazing animals. It also occurs in random areas throughout the complex. No usable vegetation grows on Rock outcrop.

The profile of the Middle soil in this complex is similar to that described as representative for the Middle series. This soil formed in residuum and colluvium derived from basalt; the surface layer is cobbly loam, and the subsoil is gravelly heavy silt loam or gravelly silty clay loam. In tbe subsoil, value is 6 or 7 when the soil is dry and ranges from 3 to 5 when it is moist, and a few thin clay films are on ped faces in some places. Rock outcrop in this complex is mainly basalt. Runoff is medium, and the hazard of erosion is slight for this complex.

This complex is used for range and wildlife habitat. Capability unit VIe–U, nonirrigated; Upland Loam range site.

Middle-Rock outcrop complex, 30 to 60 percent slopes (MKG).—This mapping unit is on the mountains in the northern part of Hansel Valley. It consists of about 50 percent Middle cobbly loam, 30 to 60 percent slopes, and about 30 percent Rock outcrop. Included with this unit in mapping are areas of Rock land; Sandall cobbly silt loam, 30 to 70 percent slopes; and Gemson silty clay loam, 10 to 20 percent slopes. These included areas make up about 20 percent of the total acreage.

This complex is mainly on south- and west-facing slopes. The Middle soil has slightly concave slopes. Its plant cover is mostly sagebrush and bluebrunch wheat-

grass, but there is some yellowbrush, bitterbrush, juniper and annual weeds and grasses. Rock outcrop is mainly on ridgetops and knobs that are close enough together to hinder the moverment of grazing animals. It also is in random areas throughout the complex. No usable vegetation grows on Rock outcrop,

The profile of the Middle soil in this complex is similar to that described as representative for the Middle series. The soil formed in residuum and colluvium derived from basalt. The surface layer is cobbly loam, and the subsoil is gravelly heavy silt loam or gravelly or cobbly clay loam. In the subsoil, value is 6 or 7 when the soil is dry and ranges from 3 to 5 when it is moist. A few thin clay films are on ped faces in some places. Rock outcrop in this complex is mostly basalt.

This complex is used for range and wildlife habitat. Capability unit VIIe-U, nonirrigated; Upland Loam range site.

Millville Series

The Millville series consists of moderately well drained soils. These soils are on alluvial fans along the base of the Wellsville Mountains. They formed in alluvium derived mainly from dolomitic limestone. Slopes range from 0 to 4 percent. The vegetation in noncultivated areas is big sagebrush, bluebunch wheatgrass, bluegrass, buckwheat, annual grasses, and weeds. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,240 to 4,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 12 inches thick. The underlying layers, extending to a depth of 60 inches, are light brownish-gray, light-gray, and pale-brown silt loam. These soils are strongly alkaline throughout and are strongly calcareous or very strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots penetrate to a depth of 60 inches.

Millville soils are used for irrigated crops.

Representative profile of Millville silt loam, 0 to 2 percent slopes, in a cultivated field, 1,700 feet north of the south quarter corner of section 15, T. 10 N., R. 2 W., 2 miles southeast of Honeyville:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure that parts to weak, fine, granular; hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

A1—9 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; strongly alkaline (pH 8.8); clear, smooth boundary.

C1—12 to 17 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0); clear, wavy boundary.

C2—17 to 24 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and very fine pores; very strongly calcareous; strongly alkaline (pH 8.8); clear, wavy boundary.

C3—24 to 41 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) when moist; massive; very hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0); gradual, wavy boundary.

C4—41 to 53 inches, light-gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0); gradual, wavy boundary.

C5—53 to 60 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0).

Between depths of 10 and 40 inches, the texture averages silt loam and the calcium carbonate equivalent ranges from 40 to 55 percent. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated. In places there is a fluctuating water table at depths between 30 and 50 inches.

The A1 horizon is moderately alkaline or strongly alkaline and moderately or strongly calcareous. Thickness of the A1 horizon ranges from 12 to 18 inches. In the C horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 2 or 3. Reaction is moderately alkaline or strongly alkaline.

Millville silt loam, 0 to 2 percent slopes (MlA).—This soil is on west-facing slopes on alluvial fans. Slopes are medium in length. A profile of this soil is the one described as representative for the Millville series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Millville silt loam, 2 to 4 percent slopes; Roshe Springs silt loam; and Honeyville silty clay loam.

This soil is used for irrigated alfalfa, corn for silage, sweet corn, small grains, tomatoes, sugar beets, and irrigated pasture. Capability unit I-1, irrigated; range site not assigned.

Millville silt loam, 2 to 4 percent slopes (MlB).—This soil is on west-facing slopes on alluvial fans. Slopes are short to medium in length. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Millville silt loam, 0 to 2 percent slopes; Millville silt loam, moderately deep water table, 2 to 4 percent slopes; Roshe Springs silt loam; and Honeyville silty clay loam.

This soil is used for irrigated alfalfa, corn for silage, sweet corn, small grains, tomatoes, and sugar beets. Capability unit IIe-1, irrigated; range site not assigned.

Millville silt loam, moderately deep water table, 2 to 4 percent slopes (MmB).—This soil is on alluvial fans. The profile of this soil is similar to that described as representative for the Millville series, but a fluctuating water table or other characteristics associated with wetness are between depths of 30 and 50 inches. Slopes are short and slightly concave. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Millville silt loam, 2 to 4 percent slopes; Roshe Springs silt loam; and Honeyville silty clay loam.

This Millville soil is used chiefly for irrigated alfalfa, corn for silage, small grains, sugar beets, tomatoes, and irrigated pasture. A small area is used for nonirrigated

alfalfa and small grains. Capability unit IIw-2, irrigated; range site not assigned.

Munk Series

The Munk series consists of well-drained soils. These soils are on foothills and high lake terraces. They formed in residuum and colluvium derived mainly from limestone, conglomerate, and tufaceous sandstone. Slopes range from 6 to 20 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, big sagebrush, balsamroot, yellowbrush, oregongrape, bitterbrush, and annual grasses. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 110 to 130 days. Elevations range from 4,800 to 5,575 feet.

In a representative profile, the surface layer is grayish-brown gravelly silt loam about 10 inches thick. The next layer is grayish-brown gravelly heavy loam about 7 inches thick. The underlying layer, between depths of 17 and about 32 inches, is light-gray very gravelly sandy clay loam that is underlain by fractured limestone bedrock. The surface layer is moderately alkaline or strongly alkaline and moderately calcareous. The substratum is strongly alkaline and strongly calcareous. A layer of strong lime accumulation is at a depth of about 17 inches.

Permeability is moderate, and the intake rate of water is rapid. Available water holding capacity is 2 to 4 inches to bedrock. The water-supplying capacity is 7.5 to 8.5 inches before moisture is depleted. Roots penetrate to bedrock.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Munk gravelly silt loam, 10 to 20 percent slopes, in an area of Parleys-Munk complex, 10 to 20 percent slopes, in nonirrigated cropland, 1,300 feet east and 1,200 feet north of the southwest corner of section 27, T. 14 N., R. 6 W., in the northern part of Hansel Valley:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine roots; 25 percent gravel and cobblestones; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, smooth boundary.

A1—6 to 10 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 30 percent gravel and cobblestones; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

AC—10 to 17 inches, grayish-brown (10YR 5/2) gravelly heavy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few very fine pores; 35 percent gravel and cobblestones; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

Cca—17 to 32 inches, light-gray (10YR 7/2) very gravelly sandy clay loam, pale brown (10YR 6/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine and very fine pores; 60 percent gravel and cobblestones; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.

R—32 inches, fractured limestone bedrock.

Depth to the horizon of carbonate accumulation is about 17 inches. Texture between depths of 10 and 40 inches averages very gravelly light loam. Depth to bedrock ranges from 30 to 40 inches. Coarse fragments are mainly angular limestone and tufaceous sandstone of gravel and cobblestone size. The content of coarse fragments ranges from 20 to 50 percent in the A1 horizon and from 40 to 80 percent in the Cca horizon. The soils are usually moist but are dry in all parts between depths of 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry. This horizon is gravelly silt loam or gravelly loam and ranges from 7 to 12 inches in thickness. It is moderately alkaline to strongly alkaline and slightly calcareous to strongly calcareous.

In the Cca horizon, value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; chroma ranges from 2 to 4. Texture is very gravelly sandy clay loam or very gravelly sandy loam. In places the Cca horizon is weakly cemented.

Munk gravelly silt loam, 10 to 20 percent slopes (MuE).—This soil is on south- and west-facing foothills and high lake terraces. Slopes are slightly convex. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Forsgren silt loam, 10 to 20 percent slopes, and Pomat silt loam, 10 to 30 percent slopes.

This Munk soil is used for nonirrigated small grains. It is also used for range and wildlife habitat. Capability unit VIs-U, nonirrigated; Upland Stony Loam range site.

Obray Series

The Obray series consists of well-drained soils. These soils are on alluvial fans and in mountain valleys east and south of Mantua. They formed in fine-textured alluvium and colluvium derived from sandstone, quartzite, and limestone. Slopes range from 10 to 25 percent. Vegetation consists of slender wheatgrass, mountain brome, bluegrass, mulesear dock, and low sagebrush. Mean annual air temperature ranges from 41° to 43° F. Average annual precipitation ranges from 18 to 25 inches, and the frost-free period is 80 to 100 days. Elevations range from 6,000 to 6,800 feet.

In a representative profile, the surface layer is grayish-brown clay loam and clay about 37 inches thick. The underlying layers are brown and pale-brown clay that extend to a depth of 60 inches. The soils are slightly acid or neutral throughout.

Permeability is very slow, and the rate of water intake is slow. Available water holding capacity is 11 to 13 inches to a depth of 5 feet. The water-supplying capacity is about 14 to 21 inches for plant growth before moisture is depleted. Roots easily penetrate to a depth of 60 inches.

Obray soils are used for range, wildlife habitat, and water supply.

Representative profile of Obray clay, 10 to 25 percent slopes, in range, 1,520 feet west and 560 feet south of the east quarter corner of section 25, T. 9 N., R. 1 W., in Clay Valley east of Mantua:

A11—0 to 2 inches, grayish-brown (10YR 5/2) clay loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and very fine roots; one-half inch of weak, medium, granular structure under clumps of grass; slightly acid; abrupt, smooth boundary.

A12—2 to 22 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, prismatic structure that parts to strong, medium and coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots in upper part of horizon decreasing to few very fine roots in the lower part; few very fine pores; common slickensides; black organic stains on vertical faces of peds; many manganese shot (less than 1 millimeter in diameter); slightly acid (pH 6.4); gradual, wavy boundary.

A1&C1—22 to 37 inches, the A1 part is grayish-brown (10YR 5/2) clay, dark brown (7.5YR 3/2) when moist; the C1 part is yellowish-brown (10YR 5/4) clay, brown (7.5YR 4/4) when moist; both the A1 and C1 parts have weak, medium and coarse, prismatic structure that parts to strong, coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; many slickensides; many manganese shot (less than 1 millimeter in diameter); neutral (pH 6.6); gradual, irregular boundary.

C2—37 to 46 inches, brown (10YR 5/3) clay, brown (7.5YR 4/3) when moist; massive; extremely hard, very firm, very sticky and very plastic; few very fine pores; common slickensides; many manganese shot (less than 1 millimeter in diameter); slightly acid (pH 6.2); diffuse, wavy boundary.

C3—46 to 60 inches, pale-brown (10YR 6/3) clay, brown (10YR 4/3) when moist; massive; extremely hard, very firm, very sticky and very plastic; few slickensides; many manganese shot (less than 1 millimeter in diameter); slightly acid (pH 6.2).

In the foregoing profile, slickensides are on both vertical and horizontal faces but are strongest on faces at an angle of 10 to 30 degrees from horizontal.

Cracks in these soils range from ½ to 1 inch in width and extend to a depth of more than 40 inches. The surface has a gilgai microrelief that amounts to about 6 inches difference in elevation. The soils are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist. Texture is clay loam or silty clay loam in the top 2 inches, and structure is fine platy or fine to medium subangular blocky. Slickensides are common in the bottom part of the A1 horizon.

In the C horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry; and chroma is 2 or 3. Structure is weak to strong, medium to coarse, subangular blocky, or the soil is massive. Slickensides range from few to many. Reaction is slightly acid or neutral.

Obray clay, 10 to 25 percent slopes (OBE).—This soil is in mountain valleys and on alluvial fans. Slopes are slightly convex and short to medium in length. Runoff is rapid, and the hazard of erosion is high. Sheet erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are areas of Goring clay loam, 10 to 25 percent slopes, and Yeates Hollow cobbly clay loam, 20 to 30 percent slopes. One area of Obray clay in the north end of Devils Gate Valley has a browner surface layer than is allowed for the Obray series. This area represents about one-third of the total acreage of this soil.

This soil is used mainly for range but is also used for wildlife habitat and water supply. Capability unit VIe–M, nonirrigated; Mountain Clay range site.

Palisade Series

The Palisade series consists of well-drained soils on lake terraces. These soils formed in strongly calareous, mixed lake sediments derived dominantly from limestone and sandstone. Slopes range from 1 to 10 percent. Vegetation consists of big sagebrush, cheatgrass, annual mustard, Russian-thistle, and some greasewood. Mean annual air temperature ranges from 48° to 52° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 90 to 130 days. Elevations range from 4,300 to 4,840 feet.

In a representative profile, the surface layer is pale-brown silt loam about 6 inches thick. The subsoil is very pale brown silt loam about 6 inches thick. The substratum is very pale brown silt loam and light-gray loam between depths of 12 and 30 inches, and it is pale-brown very fine sandy loam that extends to a depth of 60 inches or more. These soils are moderately alkaline or strongly alkaline to a depth of 19 inches and very strongly alkaline between depths of 19 and 60 inches. They are moderately calcareous to strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Generally, the available water holding capacity is 8 to 9 inches to a depth of 5 feet. In some places, however, the soils contain enough salts below a depth of 20 inches to reduce the water available for plants to about 4 to 8 inches. In these places the water-supplying capacity is 6 to 8 inches before moisture is depleted. Most roots are in the top 24 inches of soil, but roots may penetrate to a depth of 60 inches.

These soils are used mainly for range. Very small areas are used for irrigated crops, and there is limited use by wildlife.

Representative profile of Palisade silt loam, 1 to 6 percent slopes, in range, 400 feet north and 700 feet east of the south quarter corner of section 11, T. 9 N., R. 7 W., about 7 miles southwest of Golden Spike Monument:

A1—0 to 6 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many fine and common medium pores; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, smooth boundary.

B2—6 to 12 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine vesicular pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.5); clear, smooth boundary.

C1ca—12 to 19 inches, very pale brown (10YR 7/3) light silt loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); gradual, wavy boundary.

C2ca—19 to 30 inches, light-gray (10YR 7/2) light loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; very hard, friable, nonsticky and nonplastic; few very fine roots; many very fine vesicular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); gradual wavy boundary.

C3—30 to 43 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) when moist; massive; soft, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); gradual, wavy boundary.

C4—43 to 60 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) when moist; massive; soft, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

The solum ranges from 10 to 19 inches in thickness. Between depths of 10 and 40 inches, the texture averages light silt loam and the content of clay ranges from 12 to 18 percent. Content of fine gravel is as much as 10 percent throughout. The soils

are usually dry in all parts between depths of 8 and 24 inches. These soils generally are not affected by a harmful content of salts and alkali, but in places they are slightly to strongly affected by salt and alkali.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is light silt loam or loam and ranges from 4 to 6 inches in thickness. It is moderately alkaline to very strongly alkaline.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is silt loam or loam and is 5 to 15 inches thick. It is strongly alkaline or very strongly alkaline and moderately calcareous or strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 8 when the soils are dry and is 4 or 5 when they are moist; and chroma ranges from 2 to 4. Texture is very fine sandy loam, light loam, or light silt loam. In places, gravel is at a depth below 36 inches, but the content does not exceed 30 percent. Reaction is strongly alkaline or very strongly alkaline.

Palisade silt loam, 1 to 6 percent slopes (PAB).—This soil is on lake terraces. Slopes are long and slightly convex. A profile of this soil is the one described as representative for the Palisade series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Bram silt loam; Thiokol silt loam, low rainfall, 1 to 3 percent slopes; and Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes.

This soil is used chiefly for range and wildlife. Limited areas are used for irrigated small grains, alfalfa, corn for silage, and irrigated pasture. The small acreage of irrigated crops is in an area where the frost-free period does not exceed 100 days. Capability unit IIIe-3, irrigated; capability unit VIIe-S, nonirrigated; Semidesert Loam range site.

Palisade silt loam, 6 to 10 percent slopes (PAD).—This soil is on lake terraces. Slopes are slightly convex and medium in length. Runoff is medium, and the hazard of erosion is moderate. There are a few moderately deep gullies, and rill erosion is prominent in places.

Included with this soil in mapping are small areas of Palisade silt loam, 1 to 6 percent slopes; Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes; and Stingal loam, 6 to 10 percent slopes.

This soil is used for range and wildlife. Capability unit VIIe-S, nonirrigated; Semidesert Loam range site.

Parleys Series

The Parleys series consists of well drained and moderately well drained soils. These soils are on broad lake terraces, foothills, and alluvial fans. They formed in mixed lake sediments and alluvium derived mainly from sandstone, limestone, and quartzite. Slopes range from 0 to 20 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, western wheatgrass, big sagebrush, yellowbrush, phlox, balsamroot, and annual grasses. Mean annual air temperature ranges from 45° to 51° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 110 to 160 days. Elevations range from 4,220 to 5,575 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 11 inches thick. The subsoil is brown and pale-brown silty clay loam about 36 inches thick. The substratum is pale-brown loam that extends to a depth of 60 inches. The surface layer and subsoil are mildly alkaline and moderately alkaline. The substratum is moderately alkaline to strongly alkaline and moderately calcareous. A layer of strong lime accumulation is at a depth of about 34 inches.

Permeability is moderately slow, and the rate of water intake is slow to moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 11 to 13 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated and irrigated crops. They are also used for wildlife habitat and urban development.

Representative profile of Parleys silt loam, 1 to 6 percent slopes, in a cultivated area, 200 feet south and 1,500 feet west of the east quarter corner of section 33, T. 14 N., R. 5 W., in northern Blue Creek valley:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; few fine roots; few fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

A1—6 to 11 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; mildly alkaline (pH 7.4); abrupt, smooth boundary.

B21t—11 to 19 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine pores; common thin clay films on ped faces; mildly alkaline (pH 7.6); gradual, wavy boundary.

B22t—19 to 34 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine pores; many moderately thick clay films on ped faces; moderately alkaline (pH 8.0); gradual, wavy boundary.

B3ca—34 to 47 inches, pale-brown (10YR 6/3) light silty clay loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few fine pores; few thin clay films on ped faces; moderately calcareous, lime is in veins; moderately alkaline (pH 8.4); paste; gradual, wavy boundary.

Cca—47 to 60 inches, pale-brown (10YR 6/3) heavy loam, brown (7.5YR 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Depth to the horizon of carbonate accumulation ranges from 18 to 36 inches. In places, some gravel is on the surface and throughout the profile. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated. Depth to the water table ranges from 46 inches to 60 inches or more. In places, distinct mottles are at a depth below 42 inches.

In the A1 horizon, value is 4 to 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 to 3. This horizon is silt loam, loam, or light silty clay loam and ranges from 7 to 14 inches in thickness. It is mildly alkaline or moderately alkaline and generally is noncalcareous, but it may be slightly calcareous where the soil is irrigated.

In the B2t horizon, hue is 10YR and 7.5YR; value ranges from 4 to 6 when the soils are dry and from 3 to 5 when they are moist; and chroma ranges from 2 to 4. Texture is silty clay loam or light silty clay loam and the content of clay ranges from 28 to 35 percent. Structure is weak or moderate, prismatic or blocky. Clay films are few to continuous and thin to moderately thick on ped faces. Reaction is mildly alkaline to strongly alkaline. The B3ca horizon generally begins just below the B2t horizon.

In the Cca horizon, hue ranges from 7.5YR to 2.5Y; value ranges from 6 to 8 when the soils are dry; and chroma ranges

from 2 to 4. Texture is mainly silty clay loam, silt loam, or loam, but in places the horizon is stratified and has layers of very fine sandy loam 1/8 to 3/4 inch thick.

Parleys loam, 0 to 3 percent slopes (PbA).—This soil is on broad, low and intermediate lake terraces and alluvial fans in Bear River valley south of Garland and the benchlands south of Brigham City. Runoff is slow, and the hazard of erosion is slight. This soil is well drained. Average annual precipitation is 14 to 18 inches, and the frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Fielding silt loam, warm; Honeyville silty clay loam; Kilburn gravelly sandy loam, 3 to 6 percent slopes; and Timpanogos loam, 0 to 3 percent slopes. Also included are small areas of well drained to moderately well drained soils that have a subsoil of silty clay loam and slopes of 3 to 6 percent.

This Parleys soil is used for irrigated small grains, sugar beets, alfalfa, tomatoes, corn for silage, irrigated pasture, and orchards of apples, apricots, cherries, and peaches. It is also used for urban development and wildlife habitat. Capability unit I–1, irrigated; range site not assigned.

Parleys loam, cool, 0 to 3 percent slopes (PdA).—This soil is on broad, low lake terraces and alluvial fans adjacent to the valley floor in the Bear River valley area north of Garland. Runoff is slow, and the hazard of erosion is slight. This soil is moderately well drained. Average annual precipitation is 14 to 16 inches, and the frost-free period is 120 to 140 days.

Included with this soil in mapping are small areas of Fielding silt loam; Kearns silt loam, 1 to 3 percent slopes; and Timpanogos loam, cool, 0 to 3 percent slopes.

This soil is used for irrigated sugar beets, corn for silage, alfalfa, small grains, and pasture. Capability unit IIc–2, irrigated; range site not assigned.

Parleys silt loam, 0 to 1 percent slopes (PeA).—This soil is on broad lake terraces. Runoff is slow, and the hazard of erosion is slight. This soil is well drained. Average annual precipitation is 14 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 1 to 3 percent slopes, and Parleys silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains and for wildlife habitat. Capability unit IIIc–U, nonirrigated; range site not assigned.

Parleys silt loam, 1 to 6 percent slopes (PeB).—This soil is on broad lake terraces, uplands, and alluvial fans. A profile of this soil is the one described as representative for the Parleys series. Runoff is medium, and the hazard of erosion is moderate. This soil is well drained. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of DeJarnet gravelly silt loam, 1 to 6 percent slopes; Hendricks silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. It is also used for wildlife habitat. Capability unit IIIe–U, nonirrigated; range site not assigned.

Parleys silt loam, 6 to 10 percent slopes (PeD).—This soil is on lake terraces, uplands, and alluvial fans. Slopes are slightly convex and medium in length. Runoff is medium, and the hazard of erosion is moderate. This soil is well drained. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of Hendricks silt loam, 6 to 10 percent slopes; Sterling gravelly loam, 6 to 20 percent slopes; and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. It is also used for wildlife habitat. Capability unit IIIe–U, nonirrigated; Upland Loam range site.

Parleys silt loam, 10 to 20 percent slopes (PeE).—This soil is on high lake terraces, uplands, and alluvial fans. Slopes are short to medium in length and slightly convex. Runoff is rapid, and the hazard of erosion is high. Sheet and rill erosion is moderate, and shallow gullies are common. This soil is well drained. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of Forsgren silt loam, 10 to 20 percent slopes; Hendricks silt loam, 10 to 20 percent slopes; and Munk gravelly silt loam, 10 to 20 percent slopes.

This soil is used for nonirrigated small grains and for wildlife habitat. Capability unit IVe–U, nonirrigated; Upland Loam range site.

Parleys silty clay loam, 0 to 3 percent slopes (PlA).—This soil is on west-facing slopes on low lake terraces west of Willard. Slopes are medium in length and most commonly are less than 1 percent. The profile of this soil is similar to that described as representative for the Parleys series, but it is finer textured throughout. Runoff is slow, and the hazard of erosion is slight. This soil is well drained. Average annual precipitation is 14 to 17 inches, and the frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Parleys loam, 0 to 3 percent slopes.

This soil is used chiefly for irrigated small grains, alfalfa, sugar beets, corn for silage, and irrigated pasture. A small area is used for nonirrigated small grains. Capability unit I–1, irrigated; range site not assigned.

Parleys-Munk complex, 6 to 10 percent slopes (PmD).—This mapping unit is on uplands in the northern part of Blue Creek valley and Hansel Valley. It consists of about 60 percent Parleys silt loam, 6 to 10 percent slopes, and about 25 percent Munk gravelly silt loam, 6 to 10 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 6 to 10 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; and Pomat silt loam, 6 to 10 percent slopes. These included soils make up about 15 percent of the total acreage.

The soils of this complex are intermingled. The Parleys soil is between the knolls and ridges. Its slopes are medium in length and slightly concave. The Munk soil is on the knolls and ridges. Its slopes are short and convex.

The profile of the Parleys soil in this complex is similar to that described as representative for the series. This Parleys soil is well drained. The profile of the Munk soil in this complex is similar to that described as representative for the Munk series, but it has not been affected by moderate sheet and rill erosion. Runoff is medium on these soils, and the hazard of erosion is moderate.

The soils of this complex are used for nonirrigated small grains and for wildlife habitat. Capability unit IIIe–U, nonirrigated; range site not assigned.

Parleys-Munk complex, 10 to 20 percent slopes (PmE).—This mapping unit is on uplands in the northern part of Blue Creek valley and Hansel Valley. It consists of about 60 percent Parleys silt loam, 10 to 20 percent slopes, and 25 percent Munk gravelly silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 10 to 20 percent slopes, and Pomat silt loam, 10 to 30 percent slopes. These included soils make up about 15 percent of the total acreage.

Soils of this complex are closely intermingled. The Parleys soil is on north- and east-facing uplands. Its slopes are short to medium in length and are slightly concave. The Munk soil is on knolls and ridges. Its slopes are convex.

The profile of the Parleys soil in this complex is similar to that described as representative for the series. This Parleys soil is well drained. A profile of the Munk soil in this complex is the one described as representative for the Munk series. Runoff is rapid on these soils, and the hazard of erosion is high. Sheet and rill erosion is moderate, and a few shallow gullies have been formed.

The soils of this complex are used for nonirrigated small grains, range, and wildlife habitat. Capability unit IVe–U, nonirrigated; Upland loam range site.

Parleys-Pomat silt loams, 6 to 10 percent slopes (PnD).—This complex is on intermediate and high lake terraces and on uplands that are slightly above the highest lake terraces. It consists of about 50 percent Parleys silt loam, 6 to 10 percent slopes, and 35 percent Pomat silt loam, 6 to 10 percent slopes. Included with these soils in mapping are areas of Kearns silt loam, 6 to 10 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes. These included soils make up about 15 percent of the total acreage.

The Parleys soil is in flat or slightly concave areas. The Pomat soil is on convex knolls and ridges and escarpments of terraces.

Runoff is medium on these soils. The hazard of erosion is slight to moderate on the Parleys soil and is moderate on the Pomat soil.

The soils of this complex are used for nonirrigated small grains and wildlife habitat. Capability unit IIIe–U, nonirrigated; range site not assigned.

Pass Canyon Series

The Pass Canyon series consists of well-drained soils. These soils are on mountain slopes at the southern end of the Promontory Mountains. They formed in residuum and colluvium derived from quartzite and sandstone. Slopes range from 6 to 30 percent. Vegetation consists of bluebunch wheatgrass, bluegrass, Indian ricegrass, big sagebrush, and yellowbrush. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 105 to 120 days. Elevations range from 4,300 to 5,240 feet.

In a representative profile, the surface layer is brown loam and silt loam about 11 inches thick. The subsoil is yellowish-brown cobbly light clay loam, about 9 inches thick, that is underlain by quartzite bedrock at a depth of 20 inches. The soil is neutral throughout.

Permeability is moderate, and the rate of water intake is moderately slow. Available water holding capacity is 2.5 to 3.5 inches to bedrock. The water-supplying capacity is 6.5 to 8 inches before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range.

Representative profile of Pass Canyon loam, 6 to 30 percent slopes, in an area of Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes, in range, 600 feet east and 450 feet south of the west quarter corner of section 21, T. 6 N., R. 5 W.:

A11—0 to 4 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; moderate, thick, platy structure that parts to moderate, thin, platy; hard, friable, slightly sticky and slightly plastic; many fine roots; neutral (pH 6.8); clear, wavy boundary.

A12—4 to 11 inches, brown (10YR 5/3) heavy silty loam, dark brown (10YR 3/3) when moist; strong, fine, granular structure; slightly hard, very friable, sticky and slightly plastic; common fine roots; neutral (pH 6.6); clear, wavy boundary.

B2t—11 to 20 inches, yellowish-brown (10YR 5/4) cobbly light clay loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse, subangular blocky structure that parts to weak, fine, subangular blocky; slightly hard, firm slightly sticky and plastic; common fine roots; 30 percent cobblestones; thin continuous clay films on ped faces; neutral (pH 6.8); abrupt, irregular boundary.

R—20 inches, fractured quartzite bedrock.

Depth to fractured quartzite bedrock ranges from 14 to 20 inches. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, texture is loam, silt loam, or heavy silt loam that is 0 to 15 percent gravel. Reaction is neutral or mildly alkaline. This horizon ranges from 11 to 13 inches in thickness. In the B2t horizon, value is 5 to 6 when the soils are dry. Texture is cobbly light clay loam or cobbly light silty clay loam, and reaction is neutral to mildly alkaline. The B2t horizon ranges from 7 to 9 inches in thickness.

Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes (POE).—This mapping unit is on the southern end of the Promontory Mountains. It consists of about 75 percent Pass Canyon loam, 6 to 30 percent slopes, and 20 percent Rock outcrop. Included with this unit in mapping are areas of Hupp gravelly silt loam, 10 to 20 percent slopes. These included areas make up about 5 percent of the total acreage.

The Pass Canyon soil is on mountain slopes having all exposures and is under a cover of bluebunch wheatgrass and big sagebrush. A profile of this soil is the one described as representative for the series. Mainly, slopes are slightly convex and 6 to 15 percent. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is in small areas, 5 to 50 feet across, throughout the mapping unit. The outcropping rock is mainly quartzite.

This complex is used for range. Capability unit VIIs–U, nonirrigated; Upland Shallow Loam range site.

Payson Series

The Payson series consists of somewhat poorly drained soils that are affected by alkali. These soils are on low lake terraces and lake plains. They formed in alluvium and mixed lake sediments derived from limestone, sandstone, and quartzite. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is greasewood, saltgrass, annual mustard, cheatgrass, and annual weeds. Mean annual air temperature ranges from 46° to 50° F. Average

annual precipitation ranges from 12 to 16 inches, and the frost-free period is 120 to 150 days. Elevations range from 4,215 feet to 4,350 feet.

In a representative profile, the surface layer is light brownish-gray and light-gray silt loam about 6 inches thick. The subsoil is grayish-brown clay about 8 inches thick. The substratum, which extends to a depth of 60 inches, is white clay loam and loam in the upper part and light-gray silt loam and very pale brown silty clay loam in the lower part. The surface layer is mildly alkaline and noncalcareous. The subsoil and substratum are strongly alkaline or very strongly alkaline and slightly calcareous to strongly calcareous. A layer of strong lime accumulation is at a depth of 14 inches.

Permeability is very slow in the subsoil but is moderately slow in the substratum. The rate of water intake is slow. Because of the salt content, the water available to plants is only about 4 to 8 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 11 inches to that depth. Most roots are in the upper 16 inches of soil, but roots of some plants may penetrate to a depth of more than 60 inches.

Payson soils are used for range and irrigated crops.

Representative profile of Payson silt loam, 1,900 feet south and 140 feet west of the north quarter corner of section 21, T. 9 N., R. 2 W., about 2 miles west of Box Elder High School near Brigham City:

A2p—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, platy structure that parts to weak, fine, granular; soft, friable, nonsticky and nonplastic; few fine roots; many fine vesicular pores; mildly alkaline (pH 7.5); abrupt, smooth boundary.

A2—5 to 6 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, moderately thin, platy structure; soft, friable, nonsticky and nonplastic; few fine roots; common fine vesicular pores; mildly alkaline (pH 7.5); abrupt, smooth boundary.

B2t—6 to 14 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, medium, columnar structure that parts to strong, fine and medium, subangular blocky; hard, extremely firm, sticky and plastic; few fine roots; few fine interstitial pores; continuous moderately thick clay films on ped faces; ped faces are noncalcareous, interiors are slightly calcareous; strongly alkaline (pH 8.9); abrupt, wavy boundary.

C1ca—14 to 17 inches, white (2.5Y 8/2) clay loam, light yellowish brown (2.5Y 6/3) when moist; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; massive; very hard, firm, slightly sticky and slightly plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.7); abrupt, smooth boundary.

C2—17 to 24 inches, white (2.5Y 8/2) loam, olive (5Y 5/3) when moist; few, fine, distinct, light olive-brown (2.5Y 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.7); clear, wavy boundary.

C3—24 to 32 inches, light-gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; few, fine, faint, light olive-brown (2.5Y 5/6) mottles; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6); gradual, wavy boundary.

C4—32 to 60 inches, very pale brown (10YR 7/3) silty clay loam, grayish brown (2.5Y 5/2) when moist; stratified with layers of very fine sandy loam ⅛ to ¼ inch thick; common, fine, faint, light olive-brown (2.5Y 5/6) mottles; massive; hard, firm, sticky and plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Depth to the horizon of carbonate accumulation ranges from 11 to 16 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated. Depth to the water table ranges from 32 to 48 inches unless the soils are drained. Distinct mottles are below a depth of 14 inches and range from common to many and from fine to medium. These soils are severely affected by alkali and moderately affected by salts.

In the A2 horizon, value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist. This horizon is silt loam or loam and ranges from 4 to 7 inches in thickness. It is mildly alkaline or moderately alkaline.

In the B2t horizon, hue is 10YR or 2.5Y; value ranges from 5 to 7 when the soils are dry and from 3 to 5 when they are moist; and chroma is 2 or 3. This horizon is dominantly clay but may be heavy silty clay loam or silty clay. Structure ranges from medium to coarse and is columnar or prismatic. Clay films range from moderately thick to thick and from common to continuous on ped faces. Reaction is moderately alkaline to very strongly alkaline. Ped faces are mostly noncalcareous, but interiors range from slightly calcareous to strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and is 5 or 6 when they are moist; and chroma is 2 or 3. This horizon is silty clay loam, clay loam, silt loam, or loam and in places is stratified with thin layers of fine sandy loam. It is strongly alkaline or very strongly alkaline and moderately calcareous to strongly calcareous.

Payson silt loam (Pr).—This soil is on low lake terraces and lake plains. Slopes are 0 to 1 percent. The surface is uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Airport silt loam; Lasil silt loam; Saltair silty clay loam; and Playas.

This soil is used mainly for range, but a small area is used for irrigated small grains and alfalfa. Improved range is mostly in tall wheatgrass. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Peteetneet Series, Moderately Deep Variant

The Peteetneet series, moderately deep variant, consists of very poorly drained soils. These soils are on lake plains and in nearly level depressions on low lake terraces in an area southwest of Tremonton. They formed in fibrous peat and muck deposits and fine-textured mixed lake sediments. Slopes range from 0 to 3 percent. Vegetation consists of sedges, tules, wiregrass, rushes, and cattails. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 130 to 145 days. Elevations range from 4,225 to 4,260 feet.

In a representative profile, the surface layer is black peat about 7 inches thick. The subsurface layer is very dark grayish-brown and grayish-brown muck about 11 inches thick. The next layer extends to a depth of 60 inches or more. It is grayish-brown silt loam in the upper 6 inches and light greenish-gray, light-gray, and pink silty clay in the lower part. The organic layers are neutral to moderately alkaline and the mineral soil material is moderately alkaline to strongly alkaline and slightly calcareous to strongly calcareous.

Permeability is moderate to a depth of 24 inches but is slow below that depth. The rate of water intake is moderate. Available water holding capacity is 11 to 13 inches to a depth of 5 feet. Roots can penetrate to a depth of 60 inches.

These soils are used for wildlife and range.

Representative profile of Peteetneet peat, moderately deep variant, in range, 1,775 feet east and 800 feet north of the southwest corner of section 24, T. 11 N., R. 4 W., about 5 miles southwest of Tremonton:

Oa1—0 to 7 inches, black (5Y 2/1) peat, very dark brown (10YR 2/2) when moist; soft, friable, nonsticky and nonplastic; neutral (pH 7.3); abrupt, wavy boundary.

Oa2—7 to 13 inches, very dark grayish-brown (10YR 3/2) muck and a few root fibers, black (10YR 2/1) when moist; slightly hard, friable, slightly sticky and slightly plastic; moderately alkaline (pH 8.5); clear, irregular boundary.

Oa3—13 to 18 inches, grayish-brown (10YR 5/2) muck and a few root fibers, black (10YR 2/1) when moist; slightly hard, firm, slightly sticky and slightly plastic; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.

A11g—18 to 24 inches, grayish-brown (10YR 5/2) heavy silt loam, black (10YR 2/1) when moist, ped faces gray (2.5Y 5/1) when dry; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable, sticky and slightly plastic; moderately alkaline (pH 8.4); abrupt, wavy boundary.

A12g—24 to 26 inches, grayish-brown (10YR 5/2) light silty clay, very dark gray (10YR 3/1) when moist, ped faces gray (5Y 5/1) when dry; weak, medium to fine, prismatic structure; hard, firm, slightly sticky and plastic; slightly calcareous; moderately alkaline (pH 8.4); abrupt, irregular boundary.

C1cag—26 to 34 inches, light greenish-gray (5GY 7/1) silty clay, light olive gray (5Y 6/2) when moist, ped faces greenish gray (GY 5/1) when dry; weak, coarse, prismatic structure; extremely hard, very firm, very sticky and very plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, irregular boundary.

C2cag—34 to 54 inches, light-gray (5Y 7/1) silty clay, light olive gray (5Y 6/2) when moist, ped faces greenish gray (5GY 6/1) when moist; few, fine, prominent, light olive-brown (2.5Y 5/6) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, wavy boundary.

C3g—54 to 66 inches, light-gray (5Y 7/1) silty clay, gray (5Y 6/1) when moist; many, medium and coarse, prominent, light olive-brown (2.5Y 5/6) mottles; massive; extremely hard, very firm, very sticky and plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C4—66 to 74 inches, pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) when moist; massive; extremely hard, extremely firm, very sticky and plastic; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth of peat and muck over mineral soil ranges from 18 to 36 inches. Generally, the water table is at or near the surface most of the time. In places, however, the overflow water is diverted and the depth to the water table is mainly between 20 and 48 inches.

The Oa1 horizon is dominantly coarse, fibrous, noncalcareous peat that is neutral or mildly alkaline and ranges from 7 to 11 inches in thickness. The Oa2 and Oa3 horizons are mainly muck with a few root fibers. They are noncalcareous to slightly calcareous and mildly alkaline or moderately alkaline. Thickness of the muck horizons ranges from 11 to 26 inches.

In the mineral soil material, hue ranges from 7.5YR to 5GY; value ranges from 5 to 7 when the soils are dry and from 2 to 6 when they are moist; and chroma is 1 or 2. Texture is mainly silty clay but is silty clay loam or heavy silt loam in parts. The C horizons are laminated lake sediments.

Peteetneet peat, moderately deep variant (Ps).—This soil is on lake plains and nearly level depressions or low lake terraces. Most of the acreage is in the Salt Creek Waterfowl Management Area about 5 miles southwest of Tremonton. Slopes most commonly are less than 1 percent but range from 0 to 3 percent. Runoff is very slow, and the hazard of erosion is none.

Included with this soil in mapping are small areas of Airport silt loam and Fresh water marsh.

This soil is used for waterfowl habitat and native pasture. Capability unit VIIw-2, nonirrigated; Wet Meadow range site.

Picayune Series

The Picayune series consists of well-drained soils. These soils are on south- and west-facing slopes east of Mantua. They formed in colluvium derived from limestone. Slopes range from 40 to 70 percent. Vegetation consists of bluebunch wheatgrass, slender wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 43° to 45° F. Average annual precipitation ranges from 18 to 24 inches, and the frost-free period is 70 to 100 days. Elevations range from 5,200 to 6,500 feet.

In a representative profile, the surface layer is dark grayish-brown gravelly loam about 14 inches thick. The subsoil is yellowish-brown gravelly loam about 13 inches thick. The substratum, reaching to a depth of 60 inches or more, is yellowish-brown gravelly loam in the upper part and pale-brown very gravelly loam in the lower part. The surface layer and subsoil are noncalcareous, and the substratum is strongly calcareous. The surface layer is mildly alkaline, and the subsoil and substratum are moderately alkaline.

Permeability is moderate, and the rate of water intake is rapid. Runoff is rapid, and the hazard of erosion is high. Available water holding capacity is 12 to 15 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used for range and wildlife habitat.

Representative profile of Picayune gravelly loam, 40 to 70 percent slopes, in an area of Agassiz-Picayune association, very steep, in range, 300 feet west and 600 feet north of the south quarter corner of section 35, T. 9 N., R. 1 W., southeast of Mantua:

A1—0 to 14 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; 25 percent gravel; mildly alkaline (pH 7.8); gradual, wavy boundary.

B2—14 to 27 inches, yellowish-brown (10YR 5/4) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and very fine pores; 30 percent gravel; moderately alkaline (pH 8.0); gradual, wavy boundary.

C1ca—27 to 40 inches, yellowish-brown (10YR 5/4) gravelly loam, brown (10YR 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and very fine pores; 34 percent gravel; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); diffuse, wavy boundary.

C2ca—40 to 60 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) when moist; massive; very hard, friable, slightly sticky and nonplastic; 60 percent gravel; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth to the horizon of carbonate accumulation ranges from 23 to 28 inches. Content of gravel ranges from 10 to 30 percent in the A1 horizon, 20 to 30 percent in the B2 horizon, and 20 to 80 percent in the Cca horizon. Between depths of 10 and 40 inches, the texture averages gravelly loam that is about 30

percent gravel. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, chroma is 2 or 3. Texture is mainly gravelly loam but may be loam. Reaction is mildly alkaline or moderately alkaline. In the B2 horizon, value is 4 or 5 when the soils are dry and 3 or 4 when they are moist; chroma is 3 or 4. This horizon is mildly alkaline or moderately alkaline and is noncalcareous or slightly calcareous. In the Cca horizon, value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma is 3 or 4. Texture is gravelly loam or very gravelly loam. Reaction is moderately alkaline or strongly alkaline.

In this survey area the Picayune soils are mapped only in an association with the Agassiz soils. A description of this association is given under the heading "Agassiz Series."

Placeritos Series

The Placeritos series consists of somewhat poorly drained, stratified soils that are affected by salts and alkali. These soils are on broad river flood plains south of Corinne. They formed in mixed alluvium. Slopes range from 0 to 2 percent. Vegetation consists of saltgrass, alkali sacaton, and annual weeds and annual grasses. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,220 to 4,240 feet.

In a representative profile, the surface layer is grayish-brown silt loam over light brownish-gray silty clay loam about 16 inches thick. Layers below the surface layer are stratified, gray silt loam, light-gray loam, light-gray very fine sandy loam, and pale-brown fine sandy loam and extend to a depth of 60 inches or more. These soils are moderately or strongly calcareous throughout and are moderately alkaline or strongly alkaline.

Permeability is moderately slow, and the rate of water intake is moderate. Because the salt content is high, the water available to plants is only about 3 to 5 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 8 to 11 inches to that depth. Depth of rooting is limited by the height of the water table, but rooting may be as deep as 60 inches where the soils are drained.

Placeritos soils are used for range and wildlife habitat.

Representative profile of Placeritos silt loam, in range, 1,400 feet east and 1,250 feet north of the southwest corner of section 19, T. 9 N., R. 2 W., 5 miles west of Brigham City:

Ap—0 to 6 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

A11—6 to 11 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (10YR 5/2) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, slightly sticky and plastic; few very fine, fine, and medium roots, many very fine tubular pores; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.

A12—11 to 16 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (10YR 5/2) when moist; weak, medium and coarse, prismatic structure that parts to moderate, medium and coarse, subangular blocky; very hard, firm, sticky and plastic; few fine and very fine roots; many very fine tubular pores; many snail shell fragments; moderately calcareous; moderately alkaline (pH 8.4); abrupt, wavy boundary.

Alb—16 to 22 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; weak, medium and coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, friable, slightly sticky and plastic; few fine and very fine roots; many very fine tubular pores; many snail shell fragments; moderately calcareous; strongly alkaline (pH 8.8); gradual, irregular boundary.

C1—22 to 31 inches, light-gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine tubular pores; few snail shell fragments; moderately calcareous strongly alkaline (pH 9.0); gradual, wavy boundary.

C2—31 to 43 inches, light-gray (10YR 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many fine and very fine tubular pores; few snail shell fragments; moderately calcareous; strongly alkaline (pH 8.7); gradual, wavy boundary.

C3—43 to 51 inches, light-gray (10YR 7/2) loam, grayish brown (2.5Y 5/2) when moist; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine tubular pores; moderately calcareous; strongly alkaline (pH 8.8); gradual, wavy boundary.

C4—51 to 62 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; many, medium, distinct, yellowish-brown (10YR 6/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; strongly calcareous; strongly alkaline (pH 8.6).

The soils are saturated in all parts for 1 to 3 weeks in most years early in spring. Mottling or a chroma of 1 is at a depth of 6 to 22 inches. Mottles are few to many and faint to distinct. Depth to the water table is commonly 20 to 40 inches. These soils are moderately to very strongly affected by salts and alkali.

In the Al horizon, hue is 10YR or 2.5Y; value is 5 or 6 when the soils are dry and 4 or 5 when they are moist. This horizon is silty clay loam, silt loam, loam, very fine sandy loam, or fine sandy loam, and it ranges from 6 to 16 inches in thickness. It is moderately alkaline to very strongly alkaline and moderately calcareous or strongly calcareous.

In the C horizon, and included Alb horizon, hue is 10YR or 2.5Y; value ranges from 5 to 7 when the soils are dry and from 2 to 5 when they are moist; and chroma ranges from 1 to 3. Texture is silty clay loam, silt loam, loam, very fine sandy loam, or fine sandy loam. This horizon is moderately alkaline to very strongly alkaline and moderately calcareous to strongly calcareous.

Placeritos silt loam (PT).—This soil is on broad river flood plains. Slopes are 0 to 2 percent. Runoff is slow, and the hazard of erosion is slight. This soil is subject to frequent overflow and flooding in spring.

Included with this soil in mapping are small areas of Saltair silty clay loam, Logan silty clay loam, and Fresh water marsh.

This soil is used chiefly for range. It also has value as wildlife habitat. A small acreage has been used for irrigated small grains and pasture in recent years. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Playas

Playas (PU) are a miscellaneous land type that consists of nearly level lake plains or basins that are subject to repeated inundation by salt water and salinization by evaporation of this accumulated water. These areas are

on lake plains that border the Great Salt Lake or basin areas in many locations throughout the survey area. A water table is commonly within 20 inches of the surface. The surface is smooth, crusted with salt, and patterned by cracks when dry. The soil materials are mainly strongly calcareous, mixed lake sediments of silty clay, silty clay loam, or silt loam texture.

The vegetation is sparse and includes scattered plants of pickleweed and samphire. The areas are at least 95 percent barren.

Playas are not suitable for range and have no value for farming. On the shores of Great Salt Lake, solar ponds and dikes have been constructed on Playas to impound the mineral-heavy water pumped from the lake. Valuable minerals are extracted through evaporation from the mineral-rich water of the lake. These minerals are processed by chemical plants located on the shores of the Great Salt Lake. Capability unit VIIIw-8, nonirrigated; range site not assigned.

Pogal Series

The Pogal series consists of well-drained soils. These soils occur mainly as small, isolated, rounded or long and narrow, wind-deposited mounds on lake plains. They are in the central part of the survey area on the north edge of Great Salt Lake. They formed in strongly calcareous, mixed lake sediments that were derived mainly from limestone and sandstone and have been piled into mounds by wind. These mounds are about 6 to 20 feet high and have short, abrupt side slopes of 6 to 20 percent. Slopes range from 1 to 3 percent on top of the mounds and in the areas adjoining the mounds. Vegetation consists mostly of greasewood, shadscale, Russian-thistle, and kochia, but there is also some big sagebrush and annual mustard. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 11 to 13 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,208 to 4,250 feet.

In a representative profile, these soils are very pale brown silt loam to a depth of 60 inches or more. They are strongly calcareous throughout. A layer of strong lime accumulation begins at a depth of 22 inches. The surface layer is moderately alkaline to strongly alkaline, and between depths of 13 and 60 inches or more, the soils are very strongly alkaline.

Permeability is moderate, and the rate of water intake is moderate. Because the salt content is high, the water available to plants is only about 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 8.5 to 10.5 inches before moisture is depleted. If the soils are reclaimed, the available water holding capacity is 9 to 11 inches to a depth of 5 feet. Roots penetrate easily to a depth of 60 inches.

These soils are used for range and wildlife habitat for migratory birds.

Representative profile of Pogal silt loam, rolling, in range, 700 feet east and 400 feet north of the southwest corner of section 27, T. 10 N., R. 4 W., in Public Shooting Grounds:

A11—0 to 4 inches, very pale brown (10YR 7/3) silt loam, grayish brown (10YR 5/2) when moist; weak, thin, platy structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; common fine and very fine vesicular pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.3); abrupt, smooth boundary.

A12—4 to 13 inches, very pale brown (10YR 7/3) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and nonplastic; few very fine and medium roots; common very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5); clear, wavy boundary.

C1—13 to 22 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.3); gradual, wavy boundary.

C2ca—22 to 35 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.3); clear, wavy boundary.

C3—35 to 41 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; few fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.3); clear, wavy boundary.

C4—41 to 49 inches, very pale brown (10YR 8/3) silt loam, pale olive (5Y 6/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); gradual, wavy boundary.

C5—49 to 60 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4).

Between depths of 10 to 40 inches the texture averages silt loam and the content of clay ranges from 11 to 15 percent. Depth to the horizon of carbonate accumulation ranges from 22 to 38 inches. The soils are usually dry in all parts between depths of 8 and 24 inches. In places mottles are below a depth of 30 inches; they range from fine to medium and from faint to prominent. These soils are moderately affected by salts and alkali.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is mainly silt loam but may be loam, and it ranges in thickness from 9 to 13 inches. It is moderately alkaline to very strongly alkaline and moderately calcareous or strongly calcareous.

In the C horizon, hue is 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is silt loam, very fine sandy loam, or fine sandy loam. Where present, the fine sandy loam is at depths below 40 inches. Reaction is strongly alkaline or very strongly alkaline.

Pogal silt loam, rolling (PVC).—This soil occurs mainly as small, isolated, rounded or long and narrow, wind-deposited mounds on lake plains on the north edge of Great Salt Lake in the central part of the survey area. These mounds are about 6 to 20 feet high and have short, abrupt side slopes of 6 to 20 percent. Slopes are 1 to 3 percent on top of the mounds and in the areas adjoining the mounds. Runoff is medium, and the hazard of erosion is moderate. Soil blowing is a moderate hazard, and accumulations of soil material are common.

Included with this soil in mapping are small areas of Bram silt loam; Eccles fine sandy loam, 1 to 6 percent slopes; and Stingal loam, 1 to 6 percent slopes.

This soil is used for range and wildlife habitat for migratory birds. Capability unit VIIs-S8, nonirrigated; Semidesert Alkali Flats range site.

Pomat Series

The Pomat series consists of well-drained soils. These soils are on intermediate and high lake terraces, terrace escarpments, and uplands just above the highest lake terraces. They formed in mixed lake sediments and local alluvium derived mainly from limestone and sandstone. Slopes range from 6 to 40 percent. The vegetation in noncultivated areas is dominantly bluebunch wheatgrass, big sagebrush, Sandberg bluegrass, Russian-thistle, and cheatgrass. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,600 to 5,350 feet.

In a representative profile, the surface layer is light brownish-gray silt loam about 10 inches thick. The underlying layer is white silt loam to a depth of 56 inches and is white fine sandy loam between depths of 56 and 60 inches or more. These soils are strongly calcareous to very strongly calcareous throughout. The surface layer is moderately alkaline, and the underlying layer is moderately alkaline or very strongly alkaline.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. The water-supplying capacity is 9 to 10 inches before moisture is depleted. Most roots are at depths of 10 to 20 inches, but roots may penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Pomat silt loam, 10 to 30 percent slopes, in a cultivated field, 1,000 feet south and 600 feet east of the northwest corner of section 18, T. 13 N., R. 5 W., in Howell Valley:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary.

A1—5 to 10 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and medium pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, irregular boundary.

C1—10 to 25 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine pores; strongly calcareous, lime is disseminated and some is nodular; moderately alkaline (pH 8.4); gradual, wavy boundary.

C2—25 to 56 inches, white (2.5Y 8/2) silt loam, light yellowish brown (2.5Y 6/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine pores; strongly calcareous, lime is disseminated and some is nodular; very strongly alkaline (pH 9.2); clear, wavy boundary.

C3—56 to 65 inches, white (10YR 8/2) fine sandy loam, pale brown (10YR 6/3) when moist; massive; soft, very friable, nonsticky and nonplastic; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Between depths of 10 to 40 inches, the texture averages silt loam and the content of clay ranges from 12 to 17 percent. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is silt loam or loam, and it ranges from 5 to 13 inches in thickness. It is moderately alkaline or strongly alkaline and is slightly calcareous to strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value is 7 or 8 when the soils are dry and ranges from 5 to 7 when they are moist; and chroma ranges from 2 to 4. Reaction is moderately alkaline to very strongly alkaline.

Pomat silt loam, 6 to 10 percent slopes (PwD).—This soil is on intermediate and high lake terraces. Slopes are slightly convex and medium in length. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet and rill erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes; and Thiokol silt loam, 6 to 10 percent slopes. Also included are areas in which the content of gravel and cobblestones is as much as 10 percent throughout the profile.

This soil is used for nonirrigated small grains. It is also used for wildlife habitat. Capability unit IVe–UZ, nonirrigated; range site not assigned.

Pomat silt loam, 10 to 30 percent slopes (PwE).—This soil is on intermediate and high lake terraces, escarpments, and slopes into drainageways. A profile of this soil is the one described as representative for the Pomat series. Slopes are slightly convex and short to medium in length. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common, and there are a few shallow and deep gullies.

Included with this soil in mapping are small areas of Kearns silt loam, 10 to 20 percent slopes; Munk gravelly silt loam, 10 to 20 percent slopes; and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes. Also included are areas in which the content of gravel and cobblestones is as much as 10 percent throughout the profile.

This soil is used for nonirrigated small grains and range. It is also used for wildlife habitat. Capability unit VIe–U, nonirrigated; Upland Loam range site.

Pomat silt loam, 30 to 40 percent slopes, eroded (PwG2).—This soil is on intermediate and high lake-terrace escarpments and side slopes into drainageways. Runoff is very rapid, and the hazard of erosion is very high. Severe sheet and rill erosion is common, and there are a few deep gullies and many shallow gullies.

Included with this soil in mapping are small areas of Pomat silt loam, 10 to 30 percent slopes, and Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes; a few areas of Rock outcrop; and areas in which the content of gravel and cobblestones is 0 to 10 percent in the profile.

This soil is used for range and wildlife habitat. Capability unit VIIe–U, nonirrigated; Upland Loam range site.

Pomat-Kearns silt loams, 10 to 30 percent slopes (PxE).—This complex is on dissected, intermediate and high lake terraces and escarpments. It consists of about 50 percent Pomat silt loam, 10 to 30 percent slopes, and 40 percent Kearns silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Kearns silt loam, 6 to 10 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; and Thiokol silt loam, 6 to 10 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this complex are closely intermingled. The Pomat soil is on the tops and on south and west sides of knolls and ridges. The Kearns soil is on the north and east sides of the knolls and ridges. Its slopes are slightly concave.

Runoff is rapid, and the hazard of erosion is high on these soils.

The soils of this complex are used for nonirrigated small grains and wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Pomat-Parleys silt loams, 10 to 30 percent slopes (PyE).—This complex is on dissected, intermediate and high lake terraces, escarpments of terraces, and uplands that are above the highest lake terraces. It consists of about 50 percent Pomat silt loam, 10 to 30 percent slopes, and 30 percent Parleys silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Kearns silt loam, 10 to 20 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes. These included soils make up about 20 percent of the total acreage.

Soils of this complex are intermingled. The Pomat soil is on south- and west-facing slopes, and the Parleys soil is in slightly concave areas on north- and east-facing slopes. Runoff is rapid, and the hazard of erosion is high. Sheet and rill erosion is moderate, and there are a few shallow gullies.

The soils of this complex are used for nonirrigated small grains and wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Promo Series

The Promo series consists of somewhat excessively drained soils. These soils are on mountains or mountain foot slopes, mainly in the Promontory and Hansel Mountains. They formed in very gravelly and cobbly, medium-textured colluvium and residuum derived dominantly from limestone rocks. Slopes range from 30 to 60 percent. Vegetation consists of juniper, bitterbush, big sagebrush, bluebunch wheatgrass, cheatgrass, and annual weeds and grasses. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 2 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 5,200 to 6,500 feet.

In a representative profile, the surface layer is pale-brown cobbly silt loam about 7 inches thick. The underlying layer is pale-brown cobbly loam that is about 7 inches thick over limestone bedrock. The surface layer is moderately alkaline or strongly alkaline and moderately calcareous. The underlying layer is strongly alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is slow. Available water holding capacity is 2 to 3 inches above bedrock, and the soils can furnish about 4 to 5 inches of water for plant growth before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range and wildlife.

Representative profile of Promo cobbly silt loam, 30 to 60 percent slopes, in an area of Sandall-Promo association, steep, in range, 650 feet west and 850 feet south of the north quarter corner of section 35, T. 8 N., R. 6 W., about 14 miles south of Golden Spike National Monument:

A11—0 to 4 inches, pale-brown (10YR 6/3) cobbly silt loam, brown (10YR 4/3) when moist; weak, medium and thin, platy structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many very fine and fine pores; 35 percent cobblestones and gravel; moderately calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.

A12—4 to 7 inches, pale-brown (10YR 6/3) cobbly silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few very fine pores; 35 percent gravel and cobblestones; moderately calcareous, lime is disseminated and occurs as thin coatings on underside of some pebbles; strongly alkaline (pH 8.6); gradual, wavy boundary.

C—7 to 14 inches, pale-brown (10YR 6/3) cobbly loam, brown (10YR 4/3) when moist; weak, fine and medium, angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; 40 percent gravel and cobblestones; strongly calcareous, lime is disseminated and occurs as coatings on the coarse fragments; strongly alkaline (pH 8.6); abrupt, irregular boundary.

R—14 inches, limestone bedrock.

Depth to bedrock ranges from 12 to 20 inches. The soils contain 30 to 80 percent angular gravel and cobblestones and a few stones throughout the profile. The soils are usually dry above the bedrock.

In the A1 horizon, value is 4 when the soils are moist; chroma ranges from 2 to 4. This horizon is gravelly and cobbly silt loam or loam or very cobbly silt loam or very cobbly loam, and it ranges from 7 to 15 inches in thickness. It is moderately alkaline or strongly alkaline and slightly calcareous to strongly calcareous.

In the C horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. Texture is very cobbly loam to very gravelly silt loam that consists of 35 to 80 percent cobblestones, gravel, and a few stones.

In this survey area the Promo soils are mapped only in an association with the Sandall soils. A description of this association is given under the heading "Sandall Series."

Red Rock Series

The Red Rock series consists of well-drained soils. These soils are on alluvial fans, on lake terraces, and in depression areas or basin areas. They formed in mixed alluvium and reworked lake sediments derived mainly from limestone and sandstone. Slopes range from 0 to 6 percent but most commonly are 0 to 3 percent. The vegetation in noncultivated areas consists of big sagebrush, Great Basin wildrye, bluebunch wheatgrass, giant ragweed, and cheatgrass. Mean annual air temperature is 50° to 53° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,350 to 5,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 17 inches thick. The subsoil is grayish-brown heavy silt loam about 20 inches thick. The substratum, extending to a depth of 60 inches or more, is light brownish-gray silt loam. The surface layer and subsoil are moderately alkaline and noncalcareous, and the substratum is moderately alkaline or strongly alkaline and slightly calcareous or moderately calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 11 to 16 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used mainly for nonirrigated crops. Some areas are used for irrigated crops.

Representative profile of Red Rock silt loam, 0 to 1 percent slopes, in a cultivated field, 1,500 feet north and

1,300 feet west of the southeast corner of section 1, T. 13 N., R. 6 W., in Blue Creek valley:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; soft, friable, nonsticky and slightly plastic; common fine roots; many fine pores; moderately alkaline (pH 8.2); abrupt, smooth boundary.

A1—9 to 17 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine pores; moderately alkaline (pH 8.2); clear, smooth boundary.

B1—17 to 25 inches, grayish-brown (10YR 5/2) heavy silt loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine pores; moderately alkaline (pH 8.2); clear, smooth boundary.

B2—25 to 37 inches, grayish-brown (10YR 5/2) heavy silt loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; moderately alkaline (pH 8.2); gradual, wavy boundary.

C1—37 to 48 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and medium pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

C2—48 to 66 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; moderately calcareous, lime is laminar and veined; strongly alkaline (pH 8.6); gradual, wavy boundary.

C3—66 to 84 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Between depths of 10 to 40 inches, the texture averages silt loam and the content of clay ranges from 24 to 27 percent. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is dominantly silt loam but may be loam, and it ranges from 17 to 34 inches in thickness. It is neutral to moderately alkaline and is mainly noncalcareous, though in places it is slightly calcareous.

The B1 horizon is 6 to 8 inches thick. In the B2 horizon, value is 5 or 6 when the soils are dry and ranges from 2 to 4 when they are moist; chroma is 2 or 3. This horizon is heavy silt loam or light silty clay loam, and it ranges from 11 to 38 inches in thickness. It is neutral to moderately alkaline.

In the C horizon, hue is 10YR or 2.5Y; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam, loam, very fine sandy loam, or fine sandy loam. The soils are commonly stratified below a depth of 36 inches. The C horizon is mildly alkaline to strongly alkaline and slightly calcareous to moderately calcareous.

Red Rock silt loam, high rainfall, 0 to 3 percent slopes (RdA).—This soil is on alluvial fans, on lake terraces, and in broad depression or basin areas that receive runoff from adjacent areas. Slopes most commonly are less than 1 percent. Runoff is slow, and the hazard of erosion is slight. Elevations range from 5,000 to 5,400 feet. Average annual precipitation ranges from 16 to 18 inches, and the water-supplying capacity is 14 to 16 inches before moisture is depleted.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes, and Hendricks silt loam, 1 to 6 percent slopes.

This Red Rock soil is used for nonirrigated small grains. Capability unit IIe–M, nonirrigated; range site not assigned.

Red Rock silt loam, 0 to 1 percent slopes (ReA).—This soil is on broad lake terraces and alluvial fans and in swalelike areas. A profile of this soil is the one described as representative for Red Rock series. Runoff is slow, and the hazard of erosion is slight. This soil is mainly in swalelike areas that receive runoff from adjacent areas. Elevations range from 4,700 feet to 5,400 feet. Average annual precipitation ranges from 14 to 16 inches, and the water-supplying capacity is 11 to 14 inches before moisture is depleted.

Included with this soil in mapping are small areas of Kearns silt loam, 1 to 3 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This Red Rock soil is used mainly for nonirrigated small grains. A small acreage is irrigated in Blue Creek valley, where sugar beets, alfalfa, and small grains are grown. Capability unit IIc–2, irrigated; capability unit IIIc–U, nonirrigated; range site not assigned.

Red Rock silt loam, 1 to 6 percent slopes (ReB).—This soil is on alluvial fans and lake terraces. Slopes are slightly concave. Runoff is medium, and the hazard of erosion is moderate. In places a few gullies have been formed in channelways. Elevations range from 4,350 to 5,400 feet. Average annual precipitation ranges from 14 to 16 inches, and the water-supplying capacity is 11 to 14 inches before moisture is depleted.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe–U, nonirrigated; range site not assigned.

Refuge Series

The Refuge series consists of somewhat poorly drained soils. These soils are on flood plains south and west of the Willard Bay Reservoir. They formed in highly stratified, calcareous, mixed alluvium derived mainly from limestone, sandstone, and quartzite. Slopes are 0 to 1 percent. Vegetation consists of saltgrass, alkali sacaton, annual mustard, foxtail, and annual weeds. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 12 to 16 inches, and the frost-free period is 130 to 150 days. Elevations range from 4,207 to 4,215 feet.

In a representative profile, the surface layer is grayish-brown loam about 7 inches thick. Between depths of 7 and 41 inches is pale-brown, stratified loam and very fine sandy loam, and between depths of 41 and 60 inches is light-gray silty clay loam. These soils are strongly alkaline throughout and are slightly calcareous to moderately calcareous.

Permeability is moderate, and the rate of water intake is moderate. Because the salt content is high, the water available to plants is only 3 to 5 inches to a depth of 5

feet. If the soils are reclaimed, however, the available water holding capacity is 9 to 11 inches to that depth. Roots penetrate to a depth of more than 60 inches if the soils are drained, but most roots are in the uppermost 19 inches.

Refuge soils are used for range and waterfowl habitat.

Representative profile of Refuge loam, in an area of Saltair-Refuge complex, in range, 55 feet east and 750 feet north of the southwest corner of section 17, T. 7 N., R. 2 W., one-eighth mile south of Willard Bay Reservoir:

A11—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; weak, thin, platy structure that parts to weak, fine, granular; slightly hard, friable, nonsticky and slightly plastic; common fine and few medium roots; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

A12—3 to 7 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and few medium roots; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

C1—7 to 12 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) when moist; common, medium, distinct, strong-brown (7.5YR 4/6) mottles; weak, coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots; common very fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.

C2—12 to 19 inches, pale-brown (10YR 6/3) light loam, brown (10YR 4/3) when moist; few, medium, distinct, strong-brown (7.5YR 4/6) mottles; slightly hard, very friable, nonsticky and slightly plastic; few fine and medium roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.

C3sa—19 to 25 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) when moist; many, medium, distinct, strong-brown (7.5YR 4/6) mottles; massive; soft, very friable, nonsticky and nonplastic; few fine roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.

C4sa—25 to 33 inches, pale-brown (10YR 6/3) light loam, brown (10YR 4/3) when moist; many, medium, distinct, strong-brown (7.5YR 4/6) mottles; massive; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8); gradual, smooth boundary.

C5sa—33 to 41 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 4/3) when moist; many, coarse, prominent, strong-brown (7.5YR 4/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.

C6g—41 to 60 inches, light-gray (10YR 7/1) light silty clay loam, gray (10YR 5/1) when moist; many, coarse, prominent, strong-brown (7.5YR 4/6) mottles; massive; hard, friable, slightly sticky and plastic; common very fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8).

Texture averages light loam between depths of 10 and 40 inches. Few to common, medium to coarse, distinct mottles are at a depth of 20 inches or less. The water table fluctuates with the season and most commonly is at a depth of 22 to 40 inches, but in some years it is less than 20 inches from the surface early in spring.

In the A1 horizon, chroma is 2 or 3. Texture is loam or light loam. The A1 horizon is slightly calcareous or moderately calcareous and is 7 to 9 inches thick. In the C horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is mainly 2 or 3, but in places chroma is 1 below a depth of 40 inches. Texture is light silty clay loam, silt loam, or very fine sandy loam. The Csa subhorizon is very strongly saline and has its upper boundary at a depth of 19 to 25 inches.

Refuge loam (Rf).—This soil is on flood plains south and west of the Willard Bay Reservoir. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. Recent deposition on the surface is common.

Included with this soil in mapping are small areas of Saltair silty clay loam and Playas.

This Refuge soil is used chiefly for range, but it has been diked and ponded in some areas and used as habitat for migratory waterfowl. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Richmond Series

The Richmond series consists of excessively drained soils. These soils are on the west slopes of the Wellsville Mountains. They formed in residuum and colluvium derived from limestone. Slopes range from 30 to 70 percent. Vegetation is mainly bluebunch wheatgrass, big sagebrush, scattered juniper, and annual grasses and weeds. Mean annual air temperature ranges from 45° to 47° F. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 100 to 200 days. Elevations range from 5,150 to 6,500 feet.

In a representative profile, the surface layer is light brownish-gray gravelly loam about 4 inches thick. The first underlying layer is light brownish-gray very gravelly loam about 5 inches thick. The next underlying layer is pale-brown very gravelly sandy loam that is about 7 inches thick and overlies limestone bedrock at a depth of about 16 inches. This layer is about 80 percent coarse fragments. The soil is strongly alkaline and strongly calcareous throughout.

Permeability is moderately rapid, and the rate of water intake is slow. Available water holding capacity is 1 to 2 inches to bedrock. These soils can furnish about 4 to 5 inches of water for plant growth before moisture is depleted. Roots extend to bedrock.

Richmond soils are used for range and wildlife habitat.

Representative profile of Richmond very stony loam, 30 to 70 percent slopes, eroded, in an area of Richmond-Middle complex, 30 to 70 percent slopes, eroded, in range, 1,200 feet south and 300 feet east of the north quarter corner of section 27, T. 11 N., R. 2 W., northeast of Honeyville:

A1—0 to 4 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure that parts to moderate, medium, granular; slightly hard, friable, slightly sticky and slightly plastic; common medium and fine roots; 40 percent angular gravel and cobblestones; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.

C1—4 to 9 inches, light brownish-gray (10YR 6/2) very gravelly loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common medium and fine roots; 60 percent angular gravel and cobblestones; very strongly calcareous; strongly alkaline (pH 8.6); gradual, irregular boundary.

C2—9 to 16 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) when moist; single grained; loose; few fine roots; 80 percent angular fragments of fractured limestone; very strongly calcareous; strongly alkaline (pH 8.5); abrupt, irregular boundary.

R—16 inches, limestone bedrock.

Depth to bedrock ranges from 11 to 19 inches. About 25 percent of the surface is covered by cobblestones and stones. The soils are usually moist but are dry above bedrock for more than 60 consecutive days in the summer.

The A1 horizon is gravelly loam or gravelly light loam; content of gravel and cobblestones ranges from 30 to 40 percent. Reaction is mildly alkaline to strongly alkaline. This horizon ranges from 3 to 7 inches in thickness.

In the C horizon, chroma is 2 or 3. The C horizon is very gravelly loam or very gravelly sandy loam that is 50 to 80 percent gravel and cobblestones. The lime content in this horizon is more than 40 percent.

Richmond-Middle complex, 30 to 70 percent slopes, eroded (RMG2).—This mapping unit is on the western slopes of the Wellsville Mountains. It consists of about 40 percent Richmond very stony loam, 30 to 70 percent slopes, eroded; 30 percent Middle cobbly silt loam, 30 to 70 percent slopes; and 20 percent Rock outcrop. Included with these soils in mapping are areas of Rock land that make up about 10 percent of the total acreage.

Soils of this complex are closely intermingled. The Richmond soil is mainly on south- and west-facing mountain slopes under a cover of bluebunch wheatgrass, sagebrush, juniper, yellowbrush, and cheatgrass. The Middle soil is mainly on short, north-facing mountain slopes under a cover of bluebunch wheatgrass, sagebrush, bitterbrush, and cheatgrass. Rock outcrop is mostly on ridgetops.

A profile of the Richmond soil in this complex is the one described as representative for the Richmond series. Runoff is rapid, and the hazard of erosion is high. Moderate sheet erosion is common, and in places many shallow gullies have been formed.

The soils of this complex are used for range and wildlife. Capability unit VIIs–U, nonirrigated; Upland Shallow Loam range site.

Ridd Series

The Ridd series consists of well-drained soils. These soils are on mountain slopes and alluvial fans along the Wasatch Mountains south of Willard. They formed in colluvium and alluvium derived from quartzite, gneiss, and schist. Slopes range from 10 to 70 percent. Vegetation consists of bluebunch wheatgrass, lupine, scattered oakbrush, and big sagebrush. Mean annual air temperature ranges from 45° to 47° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 110 to 140 days. Elevations range from 5,000 to 6,500 feet.

In a representative profile, the surface layer is brown gravelly sandy loam about 11 inches thick. The subsoil is brown gravelly sandy loam about 13 inches thick. Bedrock is at a depth of about 24 inches. The soils are neutral throughout.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 2 to 3 inches for the soil above bedrock, and the soils can furnish 7 to 9 inches of water for plant growth before moisture is depleted. Roots extend to bedrock.

Ridd soils are used for range and wildlife habitat.

Representative profile of Ridd stony sandy loam, 30 to 70 percent slopes, in an area of Ridd-Rock outcrop complex, 30 to 70 percent slopes, in range, 100 feet south of the north quarter corner of section 7, T. 7 N., R. 1 E., southeast of Willard:

O1—1 inch to 0, decaying leaves, and twigs.

A1—0 to 11 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, very friable; many fine and very fine and few medium and large roots; 3 percent stones and 30 percent gravel; neutral (pH 7.1); gradual, wavy boundary.

B2t—11 to 24 inches, brown (10YR 5/3) gravelly heavy sandy loam, dark brown (10YR 3/3) when moist; weak, fine and medium, subangular blocky structure; soft, very friable; common fine and very fine roots; 3 percent stones and 40 percent gravel; neutral (pH 6.8); abrupt, irregular boundary.

R—24 inches, fractured, weathered quartzite bedrock.

The solum ranges from 24 to 36 inches in thickness. Depth to bedrock ranges from 24 to 40 inches. From 10 to 60 percent of the surface is covered with cobblestones, stones, and boulders. Content of coarse fragments ranges from 30 to 50 percent in the A1 and B2t horizons and from 50 to 70 percent in the C horizon where this horizon is present. The soils are usually moist but in most years are dry in all parts between the depths of 8 and 24 inches for more than 60 consecutive days in the summer.

In the A1 horizon, value ranges from 2 or 3 when the soils are moist and from 4 or 5 when they are dry. This horizon is 7 to 12 inches thick.

In the B2t horizon, value ranges from 3 to 4 when the soils are moist; chroma is 3 or 4. Texture is gravelly heavy sandy loam or gravelly sandy loam. This horizon ranges from 13 to 18 inches in thickness. In the C horizon, where present, chroma ranges from 4 to 6.

Ridd-Rock outcrop complex, 10 to 30 percent slopes (RrE).—This mapping unit is on mountain slopes and alluvial fans near the Hot Springs Resort located on the Box Elder-Weber County line. It consists of about 75 percent Ridd stony sandy loam, 10 to 30 percent slopes, and 15 percent Rock outcrop. Included in mapping are areas of Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes, and Stony alluvial land. These included soils make up about 10 percent of the total acreage.

The Ridd soil is in areas closely intermingled with Rock outcrop. Its plant cover is bluebunch wheatgrass, lupine, sagebrush, and balsamroot. Elevations range from 5,000 to 5,600 feet. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet and rill erosion has occurred on the Ridd soil, and there are a few shallow gullies. Rock outcrop consists mainly of quartzite rock.

This complex is used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Ridd-Rock outcrop complex, 30 to 70 percent slopes (RrG).—This mapping unit is on mountain slopes southeast of Willard. It consists of about 75 percent Ridd stony sandy loam, 30 to 70 percent slopes, and 20 percent Rock outcrop. Included in mapping are areas of Stony alluvial land that make up about 5 percent of the total acreage.

The Ridd soil is in areas intermingled with Rock outcrop. It is under a cover of bluebunch wheatgrass, balsamroot, lupine, big sagebrush, and scattered oakbrush. A profile of the Ridd soil is the one described as representative for the series. Elevations range from 5,200 to 6,500 feet. Runoff is rapid, and the hazard of erosion is high. Sheet and gully erosion is moderate on this soil, and a few shallow and deep gullies have been formed.

Rock outcrop is mainly quartzite. It occupies ridgetops and also occurs randomly in other places.

This complex is used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Rock Land

Rock land (RS) is a miscellaneous land type that consists of rock outcrop, rock rubble, talus materials, extremely stony land, and very shallow soils. Rock outcrops generally occupy from 25 to 90 percent of the areas. The mapping unit is on very steep mountain slopes, ridges, and canyon walls. The rocks are mainly limestone and quartzite but include some sandstone, basalt, and conglomerate. The vegetation is variable but is mainly bitterbrush, big sagebrush, bluebunch wheatgrass, maple, aspen, and some juniper.

Rock land is generally considered unsuitable for range because it is too steep and rocky. It has some value for wildlife habitat. The adjacent soils provide food and cover for wildlife. In places, Rock land is used to furnish fill material for roads and embankments. Capability unit VIIIs–X, nonirrigated; range site not assigned.

Rock Outcrop

Rock outcrop (RT) is a miscellaneous land type that consists of exposures of bare bedrock. It is on mountain slopes, in areas of cliffs and ridges, and on canyon walls. The rock is mainly quartzite, limestone, and sandstone, but there is some basalt. Rock outcrop is mostly barren, though small depressional areas, crevices, and cracks have collected enough soil material to support some grass and a few trees and shrubs. Runoff is very rapid and has been the source of water for numerous destructive floods.

Rock outcrop has no value for range, but it has some value as habitat for wildlife. Capability unit VIIIs–X, nonirrigated; range site not assigned.

Roshe Springs Series

The Roshe Springs series consists of poorly drained soils. These soils are on low lake terraces and flood plains in Bear River valley. They formed in alluvium or mixed lake sediments. Slopes range from 0 to 3 percent. Vegetation is mainly wiregrass, sedges, saltgrass, and foxtail. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,225 to 4,245 feet.

In a representative profile, the surface layer is dark-gray and gray silt loam about 20 inches thick. The underlying layer is light-gray silt loam that extends to a depth of 60 inches or more. The soils are moderately alkaline throughout, and below a depth of 10 inches, they are very strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is about 10 to 12 inches to a depth of 5 feet. Depth to the water table is commonly less than 20 inches. Root penetration is limited by the water table. If the soils were drained, roots could penetrate to a depth of more than 60 inches.

Roshe Springs soils are used for irrigated crops and for range.

Representative profile of Roshe Springs silt loam, in a cultivated field, 1,200 feet west and 500 feet south of the northeast corner of section 35, T. 9 N., R. 2 W., southwest of Brigham City:

Ap—0 to 10 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and few medium roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary.

A1—10 to 20 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.

C1cag—20 to 27 inches, light-gray (2.5Y 7/1) silt loam, gray (2.5Y 5/1) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many very fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

C2g—27 to 60 inches, light-gray (2.5Y 7/2) silt loam, grayish-brown (2.5Y 5/2) when moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; hard, friable, slightly sticky and plastic; few very fine roots; many very fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Accumulations of calcium carbonate are at a depth of 7 to 15 inches, and the calcium carbonate equivalent is 40 to 80 percent. The water table fluctuates between the surface and a depth of 20 inches unless the soils are drained. Texture averages silt loam between depths of 10 and 40 inches.

In the A1 horizon, value is 3 or 4 when the soils are dry; chroma is 1 or 2. Thickness ranges from 12 to 20 inches. This horizon is moderately alkaline to very strongly alkaline and is very strongly calcareous.

In the Cca horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 3 to 7 when they are moist. Reaction is moderately alkaline or strongly alkaline. Thin, weakly cemented layers are in the C horizon.

Roshe Springs silt loam (Ru).—This soil is on low lake terraces and flood plains that receive runoff from adjacent areas. Slopes range from 0 to 3 percent but most commonly are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Logan silty clay loam, Cudahy silt loam, and a soil that is similar to this Roshe Springs soil but has a lower content of carbonates.

This Roshe Springs soil is used for range and irrigated crops. Irrigated crops are corn for silage, small grains, alfalfa, sugar beets, and improved pasture. Capability unit IIIw–2, irrigated; Wet Meadow range site.

Rough Broken Land

Rough broken land (Rv) is a miscellaneous land type that consists of very steep escarpmentlike breaks into river bottom land. It also is on very steep drainageways or V-shaped tributaries. Geologic erosion is active, and runoff is very rapid. Soil slipping is common, and the steep slopes have a succession of short, vertical exposures. In places a mantle of silt loam or very fine sandy loam or small patches of gravel cover the surface. Drainage water from higher, irrigated areas commonly causes seeps and wet spots along these escarpmentlike breaks. The vege-

tation consists of willows, rose, Great Basin wildrye, Russian-olive, boxelder, and cottonwood.

Rough broken land is used for wildlife habitat and limited grazing. It has little or no value for farming. Capability unit VIIe–U, nonirrigated; Upland Loam range site.

Rozlee Series

The Rozlee series consists of well-drained soils. These soils are on mountain slopes and mountain foot slopes. They formed in residuum and colluvium derived mainly from limestone but also from sandstone and quartzite. Slopes range from 30 to 70 percent. Vegetation is dominantly bluebunch wheatgrass, big sagebrush, bitterbrush, juniper, cheatgrass, and annual weeds and grasses. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,600 to 6,000 feet.

In a representative profile, the surface layer is grayish-brown cobbly silt loam about 8 inches thick. The subsoil is brown cobbly silt loam about 10 inches thick. The substratum is pale-brown very cobbly silt loam that is about 12 inches thick over limestone bedrock. A layer of lime accumulation is at a depth of 18 inches. The soils are strongly alkaline throughout. The surface layer is slightly calcareous, the subsoil is moderately calcareous, and the substratum is strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is moderate. Available water holding capacity is 2 to 3 inches to bedrock. The water-supplying capacity is about 5 to 7 inches for plant growth before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range and wildlife habitat.

Representative profile of Rozlee cobbly silt loam, 30 to 70 percent slopes, in an area of Sandall-Rozlee association, steep, in range, 800 feet east and 800 feet north of the southwest corner of section 27, T. 8 N., R. 6 W.:

A1—0 to 8 inches, grayish-brown (10YR 5/2) cobbly silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and few medium roots; 35 percent cobblestones and gravel; slightly calcareous; strongly alkaline (pH 8.5); gradual, smooth boundary.

B2—8 to 18 inches, brown (10YR 5/3) cobbly silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; 45 percent cobblestones and gravel; moderately calcareous; strongly alkaline (pH 8.5); gradual, irregular boundary.

Cca—18 to 30 inches, pale-brown (10YR 6/3) very cobbly silt loam, brown (10YR 5/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; 55 percent cobblestones and gravel; strongly calcareous; strongly alkaline (pH 8.5); abrupt, irregular boundary.

R—30 inches, fractured limestone bedrock; lime accumulations in the cracks.

Depth to limestone bedrock ranges from 24 to 38 inches. Coarse fragments are angular cobblestones, gravel, and a few stones that are mainly limestone but are partly sandstone and quartzite. Content of coarse fragments ranges from 20 to 35 percent in the A1 horizon, 40 to 70 percent in the B2 horizon, and 50 to 80 percent in the Cca horizon. Most of the coarse fragments are more than 2 inches in diameter. Depth to the horizon of carbonate accumulation ranges from 11 to 23 inches.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is cobbly silt loam, cobbly loam, gravelly silt loam, or gravelly loam, and it ranges from 7 to 16 inches in thickness. It is mildly alkaline to strongly alkaline and slightly calcareous to moderately calcareous.

In the B2 horizon, value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. This horizon is cobbly or very cobbly silt loam or loam, or very gravelly or gravelly silt loam or loam, and it ranges from 5 to 12 inches in thickness. It is moderately alkaline or strongly alkaline and slightly calcareous to moderately calcareous.

In the Cca horizon, values range from 5 to 7 when the soils are dry and from 4 to 6 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly silt loam, very gravelly silt loam, very cobbly loam, or very gravelly loam. Reaction is moderately alkaline or strongly alkaline.

Rozlee-Rock outcrop complex, 30 to 70 percent slopes (RWG).—This mapping unit is on mountains and mountain foot slopes. It consists of about 85 percent Rozlee cobbly silt loam, 30 to 70 percent slopes, and 10 percent Rock outcrop. Included with this unit in mapping are areas of Sandall cobbly silt loam, 30 to 60 percent slopes, that make up 5 percent of the total acreage.

The Rozlee soil is on generally east-facing mountain slopes and supports a cover of bluebunch wheatgrass, sagebrush, snakeweed, annual grasses, and juniper. Slopes are medium in length. Runoff is rapid, and the hazard of erosion is high.

Rock outcrop is in irregularly scattered areas on ridges and in prominently raised positions. The outcropping rock is mainly limestone.

This complex is used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Hills (Juniper) range site.

Saltair Series

The Saltair series consists of poorly drained, very strongly saline soils. These soils are on broad plains surrounding Great Salt Lake. They formed in mixed lake sediments and are nearly barren of vegetation. Slopes are less than 1 percent. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 110 to 150 days. Elevations range from 4,205 and 4,225 feet.

In a representative profile, the surface layer is gray silty clay loam about 7 inches thick. Between depths of 7 and 30 inches are layers of stratified, light-gray silty clay loam and heavy silt loam. Below this, and reaching to a depth of 60 inches or more, is light-gray silty clay loam. These soils are strongly calcareous and moderately alkaline throughout.

Permeability is slow, and the rate of water intake is slow. These soils are usually saturated with water, but the water available for plant growth is only 2 to 4 inches because of the very high salt content. Plants that grow on Saltair soils normally have a shallow rooting system.

In most places the Saltair soils are barren wasteland, but they have value as wildlife habitat.

Representative profile of Saltair silty clay loam in an area of Saltair-Logan association, in range, 1,900 feet west and 1,750 feet north of the southeast corner of section 4, T. 8 N., R. 2 W., southwest of Perry:

A1sa—0 to 7 inches, gray (10YR 6/1) silty clay loam, very dark gray (10YR 3/1) when moist; massive (puddled); hard, friable, slightly sticky and plastic; many very

fine pores; strongly calcareous; very strongly saline; moderately alkaline (pH 8.4); abrupt, irregular boundary.

C1sa—7 to 20 inches, light-gray (10YR 7/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine pores; very strongly saline; strongly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

C2sa—20 to 30 inches, light-gray (2.5Y 7/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, slightly sticky and plastic; very strongly saline; strongly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

C3—30 to 60 inches, light-gray (2.5Y 7/2) heavy silty clay loam, olive gray (5Y 5/2) when moist; massive; very hard, firm, sticky and very plastic; strongly calcareous; moderately alkaline (pH 8.2).

Between depths of 10 and 40 inches, the texture averages silty clay loam and the content of clay ranges from 28 to 32 percent. The soils are usually moist because the water table is at or near the surface most of the year.

In the A1sa horizon, hue is 10YR or 2.5Y; value is 3 or 4 when the soils are moist; and chroma is 1 or 2. This horizon has weak, thin, platy structure or is massive but parts to coarse, polygonal-shaped peds if the top few inches become dry. Thickness of the A1sa horizon ranges from 5 to 8 inches.

In the Csa horizon, hue ranges from 1 to 4. Texture is heavy silt loam or silty clay loam. This horizon is very strongly saline and moderately alkaline or strongly alkaline.

Saltair silty clay loam (SA).—This soil is on broad plains surrounding the Great Salt Lake. The profile of this soil is similar to that described as representative for the Saltair series, but the surface layer is 8 inches thick. Hue is 2.5Y; value is 4 when the soil is moist; and chroma is 2. The substratum has hues that range from 7.5YR to 2.5Y, and its texture is as fine as silty clay. Runoff is very slow or ponded, and there is no hazard of erosion.

Included with this soil in mapping are small areas of Logan silty clay loam, moderately saline; Playas; and Fresh water marsh.

This Saltair soil is most commonly barren wasteland, but it has been diked and ponded in some areas and used as habitat for migratory waterfowl. Capability unit VIIIw–8, nonirrigated; range site not assigned.

Saltair-Fresh water marsh association (SB).—This mapping unit is on broad plains surrounding the Great Salt Lake where streams empty into the lake. It consists of about 40 percent Saltair silty clay loam and 35 percent Fresh water marsh. Included with this unit in mapping are areas of Logan silty clay loam, moderately saline, and Playas. These included soils make up about 25 percent of the total acreage.

The Saltair soil is on nearly level lake plains. Generally, it is nearly bare but supports scattered plants of pickleweed and a few patches of saltgrass. Fresh water marsh is in slightly concave areas where water from streams stands for long periods of time. Its plant cover is mainly cattails and bulrushes. The Logan soil is in areas that have been flooded with fresh water for several years and have a thick cover of saltgrass.

Runoff is very slow or ponded, and there is no hazard of erosion.

Although the Saltair soil is mostly barren wasteland, some areas have been diked and ponded and used as waterfowl habitat. Fresh water marsh is better suited to wildlife habitat than to most other uses. Many areas are managed for use by migratory waterfowl and the trapping of muskrats. Saltair soil is in capability unit VIIIw–8, nonirrigated; range site not assigned. Fresh water marsh is in capability unit VIIIw–2, nonirrigated; range site not assigned.

Saltair-Logan association (SC).—This mapping unit is on broad plains surrounding the Great Salt Lake. It consists of about 55 percent Saltair silty clay loam and 35 percent Logan silty clay loam, moderately saline. Included with these soils in mapping are areas of Playas and Fresh water marsh. These included areas make up about 10 percent of the total acreage

Both of these soils are nearly level and are on saltwater lake plains. The Saltair soil is nearly barren; it supports only scattered plants of pickleweed and a few patches of saltgrass. The Logan soil is in areas that have been flooded with fresh water for several years and have a thick cover of saltgrass.

A profile of Saltair soil in this association is the one described as representative for the Saltair series. The profile of the Logan soil is similar to that described as representative for the Logan series, but it is moderately saline. Slopes are generally less than 1 percent. Because of the salt content, the water available to plants is only about 7 to 9 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 11 to 12 inches to that depth. Runoff is very slow, and the hazard of erosion is slight. Elevations range from 4,205 to 4,220 feet, and the frost-free period is 110 to 140 days.

The Saltair soil in this association is mainly barren wasteland, but some areas have been diked and ponded and used for wildlife habitat. The Logan soil is used for range and wildlife habitat. The Saltair soil is in capability unit VIIIw–8, nonirrigated; range site not assigned. The Logan soil is in capability unit VIIw–28, nonirrigated; Salt Meadow range site.

Saltair-Refuge complex (Sd).—This mapping unit is on broad plains surrounding Great Salt Lake. It consists of about 60 percent Saltair silty clay loam and 40 percent Refuge loam.

These soils are intermingled and have a difference in microrelief of only 6 to 18 inches. The Saltair soil is in low positions and is nearly bare; it has only a thin stand of pickleweed and a few patches of saltgrass. The Refuge soil is in slightly higher areas under a cover of saltgrass, alkali sacaton, annual mustard, and cheatgrass.

A profile of the Saltair soil in this mapping unit is similar to that described as representative for the Saltair series. A profile of the Refuge soil is the one described as representative for the Refuge series. Runoff is very slow, and the hazard of erosion is slight.

The soils in this complex are used mostly for wildlife habitat, including waterfowl habitat. Capability unit VIIw–28, nonirrigated; Alkali Bottom range site.

Sandall Series

The Sandall series consists of somewhat excessively drained soils. These soils are on mountain slopes, mountain foot slopes, and terraces. Generally they formed in gravelly and cobbly colluvium and residuum derived mostly from limestone rocks that have some sandstone and quartzite. At the lower elevations, however, the soils formed in mixed lake sediments. Slopes range from 3 to 70 percent but most commonly are 30 to 60 percent. The vegetation is mainly juniper but includes bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, bitterbrush, cheatgrass, and annual weeds. Mean annual air

temperature ranges from 48° to 52° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,350 to 6,800 feet.

In a representative profile, the surface layer is brown and pale-brown cobbly silt loam about 7 inches thick. The subsoil is very pale brown gravelly heavy loam about 9 inches thick. The substratum is light yellowish-brown and white very cobbly loam that is about 19 inches thick and extends to limestone bedrock. The surface layer is moderately calcareous and moderately alkaline, and the subsoil and substratum are strongly calcareous or very strongly calcareous and strongly alkaline to very strongly alkaline.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 3 to 4 inches above bedrock. The water-supplying capacity is about 5 to 8 inches before moisture is depleted. Most roots are concentrated in the top 20 to 30 inches of soil, but roots can penetrate to bedrock.

These soils are used for range and wildlife habitat.

Representative profile of Sandall cobbly silt loam, 30 to 60 percent slopes, in range, 1,900 feet west and 100 feet south of the northeast corner of section 13, T. 13 N., R. 8 W., about 8 miles southwest of the town of Snowville:

O1—1/2 inch to 0, pinon pine needles.

A11—0 to 2 inches, brown (10YR 5/3) cobbly silt loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; 20 percent gravel and cobblestones; moderately calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary.

A12—2 to 7 inches, pale-brown (10YR 6/3) cobbly heavy silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to granular; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and large roots; common very fine pores; 25 percent gravel and cobblestones; moderately calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

B2—7 to 16 inches, very pale brown (10YR 7/4) gravelly heavy loam, yellowish brown (10YR 5/4) when moist; moderate, fine and medium, subangular blocky structure; hard, friable, sticky and slightly plastic; common fine, medium, and large roots; common, very fine, discontinuous pores; 30 percent gravel and cobblestones; cicada holes one-half inch in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); clear, wavy boundary.

C1ca—16 to 24 inches, light yellowish-brown (10YR 6/4) very cobbly heavy loam, brown (10YR 5/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine, medium, and large roots; common, very fine, discontinuous pores; 60 percent cobblestones, gravel, and some stones; strongly calcareous, some lime coatings on coarse fragments; strongly alkaline (pH 9.0); abrupt, irregular boundary.

C2ca—24 to 35 inches, white (10YR 8/2) very cobbly loam, light gray (10YR 7/2) when moist; massive; common, very fine, discontinuous pores; 60 percent cobblestones and partially weathered limestone; very strongly calcareous, lime is strongly cemented on coarse fragments; strongly alkaline (pH 9.1); abrupt, smooth boundary.

R—35 inches, limestone bedrock.

Angular cobblestones, gravel, and a few stones cover about 25 to 40 percent of the surface. Most of the coarse fragments are more than 2 inches in diameter and are dominantly limestone and sandstone rocks. Depth to the top of the Cca horizon ranges from 10 to 19 inches. Between depths of 10 and 40 inches, the texture averages very gravelly or very cobbly loam that is 40 to 80 percent coarse fragments. Depth to limestone bedrock ranges from 22 to 40 inches. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, value is 5 or 6 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma is 2 or 3. The part of the A1 horizon having a value of 5 when dry and of 3 when moist is less than 6 inches thick. This horizon is gravelly loam, cobbly loam, gravelly silt loam, or cobbly silt loam, and its content of gravel and cobblestones is 20 to 35 percent. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is moderately calcareous or strongly calcareous and ranges from 4 to 10 inches in thickness.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. Texture is gravelly silt loam, very gravelly loam, or very gravelly silt loam. The B2 horizon is moderately alkaline or strongly alkaline and moderately calcareous or strongly calcareous.

In the Cca and C horizons, hue ranges from 7.5YR to 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is very cobbly loam, very gravelly loam, very cobbly fine sandy loam, or very gravelly fine sandy loam that is 35 to 90 percent cobblestones and gravel. Reaction is strongly alkaline or very strongly alkaline. The Cca and C horizons are strongly calcareous to very strongly calcareous and in places are weakly cemented.

Sandall cobbly silt loam, 10 to 30 percent slopes (SEE).—This soil is on generally south- and west-facing mountains or mountain foot slopes. Slopes are slightly convex and range from 10 to 30 percent but most commonly are 20 to 30 percent. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes; Rozlee cobbly silt loam, 30 to 70 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; a light-colored cobbly silt loam soil that is moderately deep over bedrock and has slopes of 20 to 30 percent; and Rock outcrop and rockslides.

This Sandall soil is used for range and wildlife habitat. Capability unit VIs–U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sandall cobbly silt loam, 30 to 60 percent slopes (SEG).—This soil is on generally south- and west-facing mountains or mountain foot slopes in the Promontory and Hansel Mountains. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the Sandall series. Runoff is rapid, and the hazard of erosion is high. Moderate sheet erosion is common, and many shallow gullies and a few deep ones have been formed in places.

Included with this soil in mapping are small areas of Promo cobbly silt loam, 30 to 60 percent slopes; Rozlee cobbly silt loam, 30 to 70 percent slopes; and Rock outcrop and rockslides.

This Sandall soil is used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sandall-Broad association, steep (SFG).—This mapping unit is on mountains and mountain foot slopes. It consists of about 65 percent Sandall cobbly silt loam, 30 to 60 percent slopes, and 25 percent Broad cobbly loam, 30 to 60 percent slopes. Included with these soils in mapping are areas of Promo cobbly silt loam, 30 to 60 percent slopes; Rozlee cobbly silt loam, 30 to 70 percent slopes; and Rock outcrop and rockslides. These included areas make up about 10 percent of the total acreage.

Soils of this association are intermingled but are in a predictable pattern. The Sandall soil has very steep,

south- and northwest-facing slopes and is under a cover of juniper, bluebunch wheatgrass, cheatgrass, and annual weeds. Its slopes are slightly convex. The Broad soil has very steep, north- and east-facing slopes and is under a cover of bluebunch wheatgrass, Sandberg bluegrass, and the juniper trees that have invaded areas of this soil. Its slopes are slightly concave.

Runoff is rapid, and the hazard of erosion is high on these soils.

The soils of this association are used for range and wildlife habitat. The Sandall soil is in capability unit VIIs–U, nonirrigated; Upland Stony Hills (Juniper) range site. The Broad soil is in capability unit VIIs–M, nonirrigated; Mountain Stony Loam range site.

Sandall-Promo association, steep (SGG).—This mapping unit is on the mountains and mountain foot slopes in the Hansel and Promontory Mountains. It consists of about 45 percent Sandall cobbly silt loam, 30 to 60 percent slopes, and 40 percent Promo cobbly silt loam, 30 to 60 percent slopes. Included with these soils in mapping are areas of Rozlee cobbly silt loam, 30 to 70 percent slopes, and Rock outcrop and rockslides. These included areas make up about 15 percent of the total acreage.

Soils of this association are intermingled. The Sandall soil on side slopes having all aspects and is under a cover of juniper, big sagebrush, bluebunch wheatgrass, cheatgrass, and annual weeds. Slopes are very steep and slightly convex. The Promo soil is on south- and west-facing slopes and is under a cover of juniper, big sagebrush, bitterbrush, bluebunch wheatgrass, cheatgrass, and annual weeds. Slopes are medium in length and slightly convex.

Runoff is rapid, and the hazard of erosion is high on these soils. Moderate sheet and rill erosion is common.

The soils of this association are used for range and wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sandall-Rock outcrop complex, 3 to 30 percent slopes (SHE).—This mapping unit is on slightly convex, mainly south- and west-facing mountain foot slopes and terraces. It consists of about 80 percent Sandall cobbly silt loam, 3 to 30 percent slopes, and 15 percent Rock outcrop. Included with this unit in mapping are areas of Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes, and Windmill gravelly loam, 10 to 20 percent slopes. These included soils make up about 5 percent of the total acreage.

The Sandall soil is gently sloping to steep and has slightly convex slopes that are short to medium in length. Its plant cover is cheatgrass, annual weeds, and some big sagebrush and bluebunch wheatgrass. This soil is similar to the soil having the profile described as representative for the series, but it is at much lower elevations and formed in mixed lake sediments. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is on ridges and in slightly raised positions. The outcropping rock is mainly limestone.

This complex is used for range and wildlife habitat. Capability unit VIIs-U, nonirrigated; Upland Stony Loam range site.

Sandall-Rozlee association, steep (SJG).—This mapping unit is on mountains and mountain foot slopes. It consists of about 50 percent Sandall cobbly silt loam, 30 to 60 percent slopes, and 45 percent Rozlee cobbly silt loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Promo cobbly silt loam, 30 to 60 percent slopes; a well-drained very cobbly silt loam that is moderately deep over bedrock and has slopes of 20 to 30 percent; and Rock outcrop and rockslides. These included areas make up about 5 percent of the total acreage.

Soils of this association are intermingled. The Sandall soil is on south- and west-facing mountain slopes that are very steep and slightly convex. The Rozlee soil is on generally north- and east-facing mountain slopes that are very steep and slightly concave. A profile of this soil is the one described as representative for the Rozlee series. Both soils support a cover of juniper, sagebrush, bitterbrush, bluebunch wheatgrass, and annual weeds and grasses.

Runoff is rapid on these soils, and the hazard of erosion is high. Sheet and rill erosion is common, and in places many shallow gullies have been formed.

The soils of this association are used for range and wildlife habitat. Capability unit VIIs-U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sanpete Series

The Sanpete series consists of somewhat excessively drained soils. These soils are on lake terraces, escarpments, steep sides of drainageways, and foothills. They are widely distributed throughout the survey area. They formed in mixed lake sediments and very gravelly and cobbly alluvium and colluvium materials derived mainly from limestone. Slopes range from 1 to 50 percent but most commonly are 6 to 30 percent. The vegetation in noncultivated areas is mainly big sagebrush, bluebunch wheatgrass, snakeweed, sand dropseed, three-awn, cheatgrass, annual weeds, and some juniper. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 8 to 14 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,350 to 5,300 feet.

In a representative profile, the surface layer is pale-brown gravelly silt loam about 10 inches thick. The subsoil is pale-brown gravelly loam about 9 inches thick. The substratum, extending to a depth of 60 inches or more, is light-gray very gravelly sandy loam in the upper part and very pale brown very gravelly silt loam and very gravelly loam in the lower part. These soils are strongly calcareous below a depth of 5 inches. The surface layer is moderately alkaline, and the subsoil and substratum are strongly alkaline to very strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 4 to 5.5 inches to a depth of 5 feet. The water-supplying capacity is about 4 to 9 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most roots are in the top 30 inches of the soil.

The Sanpete soils are used for range, nonirrigated crops, and industrial development.

Representative profile of Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes, in range, 2,100 feet north and 1,700 feet east of the southwest corner of section 6, T. 10 N., R. 7 W., about 4 miles southwest of Cedar Spring:

Ap—0 to 5 inches, pale-brown (10YR 6/3) gravelly silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; 20

percent gravel; moderately calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

A1—5 to 10 inches, pale-brown (10YR 6/3) gravelly silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky; very few fine roots; common fine and very fine vesicular pores: 25 percent gravel; strongly calcareous; moderately alkaline (pH 8.4) clear, smooth boundary.

B2—10 to 19 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 5/3) when moist; moderate, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine tubular pores; 40 percent gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); abrupt, wavy boundary.

C1ca—19 to 31 inches, light-gray (10YR 7/2) very gravelly heavy sandy loam, pale brown (10YR 6/3) when moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; few fine and medium tubular pores; 75 percent gravel; very strongly calcareous, weakly cemented; strongly alkaline (pH 8.9); abrupt, wavy boundary.

C2ca—31 to 41 inches, very pale brown (10YR 7/3) very gravelly silt loam, light yellowish brown (10YR 6/4) when moist; massive; hard, friable, nonsticky and nonplastic; few fine and very fine tubular pores; 80 percent gravel; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); diffuse, wavy boundary.

C3—41 to 56 inches, very pale brown (10YR 7/3) very gravelly silt loam, pale brown (10YR 6/3) when moist; massive; hard, friable, nonsticky and nonplastic; 80 percent gravel; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); diffuse, irregular boundary.

C4—56 to 65 inches, very pale brown (10YR 7/3) very gravelly light loam, light yellowish brown (10YR 6/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; 70 percent gravel; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4).

Depth to the horizon of carbonate accumulation ranges from 12 to 21 inches. Coarse fragments are dominantly rounded limestone of gravel size. About 20 to 50 percent of the surface is covered with gravel and some cobblestones. Between depths of 10 and 40 inches, the texture averages very gravelly light loam and the content of gravel and cobblestones ranges from 40 to 80 percent. The soils are usually dry in all parts between depths of 8 to 24 inches.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is gravelly silt loam or gravelly fine sandy loam, and the content of gravel and cobblestones ranges from 20 to 50 percent. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is slightly calcareous to strongly calcareous and is 6 to 12 inches thick.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. The B2 horizon is moderately calcareous or strongly calcareous and moderately alkaline or strongly alkaline.

In the Cca and C horizons, hue is 7.5YR or 10YR; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma ranges from 2 to 4. These C horizons are very gravelly silt loam, very cobbly silt loam, very gravelly loam, very cobbly loam, or very cobbly sandy loam, and the content of cobblestones and gravel ranges from 50 to 80 percent. The Cca and C horizons are strongly alkaline or very strongly alkaline and strongly calcareous to very strongly calcareous.

Sanpete gravelly silt loam, 6 to 30 percent slopes (SkE).—This soil is on low to intermediate lake terraces in the extreme southwestern part of the survey area. Slopes are medium in length and convex. The profile of this soil is similar to that described as representative for the Sanpete series, but the average annual precipitation for this soil ranges from 8 to 11 inches. The frost-free period is 100 to 120 days. The water-supplying capacity before moisture is depleted is about 4 to 7 inches. Runoff is medium, and the hazard of erosion is moderate. Sheet erosion is moderate, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Palisade silt loam, 6 to 10 percent slopes, and Windmill gravelly loam, 10 ot 20 percent slopes.

This Sanpete soil is used entirely for range. Capability unit VIIs–S, nonirrigated; Semidesert Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes (SIB).—This soil is on south- and west-facing slopes on intermediate and high lake terraces. Slopes are medium in length. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 8 to 9 inches.

Included with this soil in mapping are small areas of Pomat silt loam, 6 to 10 percent slopes, and Stingal loam, 1 to 6 percent slopes.

This Sanpete soil is used for range and nonirrigated small grains. Capability unit IVs–UZ, nonirrigated; Upland Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes (SID).—This soil is on intermediate and high lake terraces and terrace escarpments. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the Sanpete series. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet erosion is common, and a few shallow gullies have been formed. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 8 to 9 inches.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Pomat silt loam, 6 to 10 percent slopes; Stingal loam, 6 to 10 percent slopes; and Windmill gravelly loam, 6 to 10 percent slopes.

This Sanpete soil is used for range, nonirrigated small grains, and industrial development. Capability unit IVs–UZ, nonirrigated; Upland Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes (SIE).—This soil is on intermediate to high lake terraces, foothills, and terrace escarpments. Slopes are short to medium in length. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common, and a few shallow gullies have been formed. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 8 to 9 inches.

Included with this soil in mapping are small areas of Middle cobbly silt loam, 10 to 30 percent slopes; Pomat silt loam, 10 to 30 percent slopes; Sterling gravelly loam, 6 to 20 percent slopes; and Windmill gravelly loam, 10 to 20 percent slopes.

This Sanpete soil is used mainly for range. A small area is used for nonirrigated small grains and industrial development. Capability unit VIs–U, nonirrigated; Upland Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes (SIG).—This soil is in foothills, on terrace escarpments, and on side slopes of drainageways. Slopes

are short to medium in length and are highly dissected. Runoff is very rapid, and the hazard of erosion is very high. Sheet and gully erosion is commonly moderate to severe. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 6 to 7 inches.

Included with this soil in mapping are small areas of Middle cobbly silt loam, 30 to 70 percent slopes; Pomat silt loam, 30 to 40 percent slopes, eroded; and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

This Sanpete soil is used for range. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Saxby Series

The Saxby series consists of well-drained soils. These soils are on lake terraces, terrace escarpments, and foot slopes. They formed in basalt material that has been overwashed with strongly calcareous, mixed lake sediments. Slopes range from 1 to 30 percent. Vegetation consists of big sagebrush, squirreltail, bluebunch wheatgrass, cheatgrass, Sandberg bluegrass, and yellowbrush. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,250 to 4,900 feet.

In a representative profile, the surface layer is light brownish-gray extremely stony silt loam about 4 inches thick. The subsoil is very pale brown very cobbly silt loam about 8 inches thick. The substratum is very pale brown very cobbly silt loam about 6 inches thick. It overlies fractured basalt stones 1 to 5 feet in diameter. These soils are strongly alkaline or very strongly alkaline throughout and moderately calcareous or strongly calcareous.

Permeability is moderate, and the rate of water intake is slow. The available water holding capacity is 2 to 3 inches to the bedrock. The water-supplying capacity is 3 to 5 inches before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range and wildlife habitat.

Representative profile of Saxby extremely stony silt loam, 10 to 30 percent slopes, in an area of Saxby very stony land association, in range, 1,100 feet east and 1,400 feet north of the west quarter corner of section 25, T. 9 N., R. 7 W., about 13 miles southwest of Golden Spike National Monument:

A1—0 to 4 inches, light brownish-gray (10YR 6/2) extremely stony silt loam, dark grayish-brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common very fine interstitial pores; about 40 percent basalt stones; moderately calcareous; strongly alkaline (pH 9.0); gradual, smooth boundary.

B2—4 to 12 inches, very pale brown (10YR 7/3) very cobbly silt loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common very fine interstitial pores; about 60 percent cobblestones and stones; moderately calcareous; strongly alkaline (pH 8.8); gradual, irregular boundary.

C1ca—12 to 18 inches, very pale brown (10YR 7/3) very cobbly silt loam, brown (10YR 4/3) when moist; massive; very hard, friable, sticky and slightly plastic; few very fine roots; about 60 percent cobblestones and stones; strongly calcareous; very strongly alkaline (pH 9.2); abrupt, irregular boundary.

R—18 inches, fractured basalt; cemented lime accumulations in cracks and voids.

Depth to bedrock ranges from 17 to 20 inches. The soils are usually dry above bedrock. In the A1 horizon, value is 6 or 7 when the soils are dry; chroma is 2 or 3. This horizon is moderately alkaline or strongly alkaline and ranges from 4 to 6 inches in thickness. In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist. The B2 horizon ranges from 5 to 11 inches in thickness. In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist. This horizon is very cobbly loam or very cobbly silt loam and consists of 40 to 70 percent cobblestones and 3 to 15 percent stones. Reaction is strongly alkaline to very strongly alkaline.

Saxby-Thiokol complex, 1 to 6 percent slopes (SMB).—This mapping unit is on lake terraces in the extreme southwestern part of the survey area. It consists of about 50 percent Saxby extremely stony silt loam, 1 to 6 percent slopes, and 30 percent Thiokol silt loam, low rainfall, 1 to 6 percent slopes. Included with this unit in mapping are areas of Very stony land and Palisade silt loam, 1 to 6 percent slopes. These included areas make up about 20 percent of the total acreage.

Soils of this complex are intermingled. The Saxby soil is in slightly raised positions on ridgetops under a cover of yellowbrush, bluebunch wheatgrass, and big sagebrush. The Thiokol soil is in slightly concave positions and in the more nearly level areas between ridges. It is under a cover of bluebunch wheatgrass, squirreltail, annual mustard, and big sagebrush.

Runoff is medium, and the hazard of erosion is moderate on these soils. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 100 days. The water-supplying capacity is about 6 to 8 inches before moisture is depleted.

The soils of this complex are used for range and wildlife habitat. Capability unit VIIs–S, nonirrigated; Semidesert Shallow Loam range site.

Saxby-Very stony land association (SN).—This mapping unit is on lake terraces and mountain foot slopes in the southwestern part of the survey area. Slopes are short to medium in length. It consists of about 60 percent Saxby extremely stony silt loam, 10 to 30 percent slopes, and 30 percent Very stony land. Included with this unit in mapping are areas of Palisade silt loam, 6 to 10 percent slopes, and Sanpete gravelly silt loam, 6 to 30 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this association are closely intermingled. The Saxby soil is in slightly concave positions under a cover of bluebunch wheatgrass, squirreltail, yellowbrush, and big sagebrush. A profile of this soil is the one described as representative for the Saxby series. Runoff is medium, and the hazard of erosion is moderate. Very stony land is on ridgetops and at random locations in other parts of the association.

This association is used for range and wildlife habitat. Capability unit VIIs–S, nonirrigated; Semidesert Shallow Loam range site.

Sheeprock Series

The Sheeprock soils consist of somewhat excessively drained soils. These soils are on alluvial fans, lake terraces, and dissected lake-terrace escarpments on Fremont

Island and in the southern part of the Promontory Mountains. They formed in very gravelly alluvium and sandy beach deposits derived from limestone, sandstone, and quartzite. Slopes range from 6 to 40 percent. Vegetation is mainly cheatgrass but includes some Indian ricegrass, bluebunch wheatgrass, yellowbrush, big sagebrush, and juniper. Mean annual air temperature ranges from 48° to 52° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,220 to 5,100 feet.

In a representative profile, the surface layer is pale-brown gravelly sandy loam about 6 inches thick. Next is is a layer of pale-brown gravelly sandy loam and brown gravelly light loam about 8 inches thick. Below this, and extending to a depth of 60 inches, is gray very gravelly sand. These soils are slightly calcareous and moderately alkaline to strongly alkaline to a depth of 14 inches and are strongly calcareous and very strongly alkaline below that depth.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 2.5 to 5 inches to a depth of 5 feet. The water-supplying capacity is 6 to 7 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most roots are in the upper 20 to 30 inches of the soil.

Sheeprock soils are used for range.

Representative profile of Sheeprock gravelly sandy loam, 6 to 10 percent slopes, in range, 475 feet west and 650 feet north of the east quarter corner of section 13, T. 5 N., R. 5 W., on Fremont Island:

A1—0 to 6 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, medium and fine, granular structure; soft, friable, slightly sticky and nonplastic; common fine and very fine roots; 20 percent gravel; slightly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

C1—6 to 10 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common fine and very fine roots; 20 percent gravel; slightly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

C2—10 to 14 inches, brown (10YR 5/3) gravelly light loam, dark brown (10YR 3/3) when moist; massive; soft, very friable; few fine and very fine roots; 40 percent gravel; slightly calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.

C3—14 to 60 inches, gray (10YR 5/1) very gravelly sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose; 65 percent gravel (mainly ⅛ to ½ inch in diameter); strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Between depths of 10 and 40 inches, the texture averages very gravelly sand and the content of coarse fragments ranges from 50 to 80 percent. Depth to the very gravelly material ranges from 11 to 20 inches. The soils are usually dry in all parts between depths of 12 to 35 inches.

In the A1 horizon, value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; chroma is 2 to 4. This horizon is gravelly loam or gravelly sandy loam, and the content of fine gravel ranges from 20 to 40 percent. The horizon is mildly alkaline or moderately alkaline and is generally noncalcareous but may be slightly calcareous. In places there is no A1 horizon. In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 7 when the soils are dry and 3 to 6 when they are moist; and chroma ranges from 1 to 4. Reaction is mildly alkaline to very strongly alkaline. The C horizon is mainly strongly calcareous but ranges to slightly calcareous.

Sheeprock gravelly sandy loam, 6 to 10 percent slopes (SoD).—This soil is on south- and west-facing slopes on lake terraces and alluvial fans on Fremont Island. Slopes are slightly convex and medium in length. A profile of this soil is the one described as representative for the Sheeprock series. Texture of the surface layer is mainly gravelly sandy loam but is gravelly loam in some places. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes.

This Sheeprock soil is used for range. Capability unit VIs–U, nonirrigated; Upland Sand range site.

Sheeprock gravelly loam, 10 to 40 percent slopes, severely eroded (SpF3).—This soil is on highly dissected lake-terrace escarpments and alluvial fans. Slopes are short to medium in length. The surface layer is mainly gravelly loam but is gravelly sandy loam in places. Runoff is rapid, and the hazard of erosion is high. Gully erosion is commonly severe, and sheet and rill erosion is moderate.

Included with this soil in mapping are small areas of Blue Star gravelly loam, 6 to 20 percent slopes, and Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes.

This Sheeprock soil is used for range. Capability unit VIIs–U, nonirrigated; Upland Sand range site.

Smarts Series

The Smarts series consists of well-drained soils. These soils are on mountain slopes and in wooded canyons or ravines. They formed in alluvium derived from sandstone and quartzite. Slopes range from 30 to 70 percent. Vegetation is dominantly maple but includes some chokecherry, oregongrape, snowberry, lupine, and scattered aspen. Mean annual air temperature ranges from 40° to 46° F. Average annual precipitation ranges from 18 to 24 inches, and the frost-free period is 75 to 100 days. Elevations range from 5,400 to 7,000 feet.

In a representative profile, the surface layer is dark grayish-brown loam about 45 inches thick. The subsoil is light-brown gravelly clay loam in the upper part and brown cobbly clay loam in the lower part. It reaches to a depth of 68 inches. The surface layer is mildly alkaline, and the subsoil is moderately alkaline.

Permeability is moderate to a depth of 45 inches but is moderately slow below that depth. The rate of water intake is moderate. Available water holding capacity is 8 to 11 inches to a depth of 5 feet. The water-supplying capacity is 14 to 19 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Smarts loam, 30 to 70 percent slopes, in range, 1,600 feet north and 200 feet east of the southwest corner of section 20, T. 14 N., R. 4 W.:

A11—0 to 15 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots; few medium and coarse pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

A12—15 to 32 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few medium and coarse pores; mildly alkaline (pH 7.6); gradual, wavy boundary.

A13—32 to 45 inches, dark grayish-brown (10YR 4/2) heavy loam; very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few medium and coarse pores; mildly alkaline (pH 7.8); clear, wavy boundary.

B2t—45 to 60 inches, light-brown (7.5YR 6/4) gravelly clay loam, brown (7.5YR 3/4) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine pores; many thin clay films on ped faces; 40 percent angular gravel and fractured sandstone; moderately alkaline (pH 8.0); clear, wavy boundary.

B3—60 to 68 inches, brown (7.5YR 5/3) cobbly light clay loam, dark brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; common thin clay films on ped faces; 75 percent fractured sandstone and some cobblestones; moderately alkaline (pH 8.2).

Coarse fragments are mainly angular cobblestones and gravel of sandstone and quartzite. Their content ranges from 0 to 45 percent in the A1 horizon and from 30 to 80 percent in the B2t horizon. The soils are usually moist, but they are dry in all parts between depths of 4 to 12 inches for 60 consecutive days or more in summer.

In the A1 horizon, value is 4 to 5 when the soils are dry and 2 or 3 when they are moist; and chroma is 2 or 3. The A1 horizon is loam, silt loam, gravelly loam, or gravelly silt loam and ranges from 24 to 45 inches in thickness. Reaction is neutral to moderately alkaline.

In the B2t horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. Texture is gravelly clay loam, cobbly clay loam, very gravelly clay loam, or very cobbly clay loam. Reaction is neutral to moderately alkaline. Clay films range from common to many and from thin to moderately thick on ped faces.

Smarts loam, 30 to 70 percent slopes (SQG).—This soil is on north- and east-facing mountain slopes in narrow, wooded canyon areas or ravines. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Broad cobbly loam, 30 to 60 percent slopes; Manila loam, 25 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; and a Smarts soil that has a gravelly or cobbly surface layer.

Smarts loam, 30 to 70 percent slopes, is used for range, water supply, and habitat for big-game animals. Capability unit VIIe–M, nonirrigated; Mountain Loam (Shrub) range site.

Snowville Series

The Snowville series consists of well-drained soils. These soils are on rolling hills and foot slopes in the northern part of Hansel Valley. They formed in residuum derived mainly from basalt but partly from limestone. Slopes range from 6 to 20 percent. Vegetation consists of sagebrush, snakeweed, bluebunch wheatgrass, balsamroot, wild onion, and cheatgrass. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation is 14 to 15 inches, and the frost-free period is 110 to 120 days. Elevations range from 5,200 to 5,500 feet.

In a representative profile, the surface layer is grayish-brown gravelly silt loam about 7 inches thick. The subsoil is light brownish-gray gravelly heavy loam and cobbly light clay loam about 11 inches thick. Below this is an indurated hardpan that is about 2 inches thick and overlies basalt. The soils are moderately alkaline throughout and are slightly calcareous in the surface layer and moderately calcareous in the subsoil.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is 2.5 to 3 inches above the hardpan. The water-supplying capacity is 5 to 6 inches before moisture is depleted. Roots penetrate to the hardpan.

These soils are used for range and wildlife habitat.

Representative profile of Snowville gravelly silt loam, 6 to 20 percent slopes, in range, 500 feet north and 100 feet west of the south quarter corner of section 13, T. 14 N., R. 7 W., about 8 miles east of Snowville:

A11—0 to 3 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and few medium roots; 20 percent angular gravel; slightly calcareous, lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

A12—3 to 7 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and few medium roots; 20 percent angular gravel; slightly calcareous, lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

B21—7 to 13 inches, light brownish-gray (10YR 6/2) gravelly heavy loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and few medium roots; 20 percent angular gravel; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

B22—13 to 18 inches, light brownish-gray (10YR 6/2) cobbly light clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium roots; 30 percent angular cobblestones and gravel; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.2); abrupt, wavy boundary.

C1cam—18 to 20 inches, indurated hardpan.

R—20 inches, basalt.

Depth to the indurated hardpan ranges from 14 to 20 inches. Coarse fragments are mainly angular fragments of caliche ¼ to ¾ inch in size. A few large stones and cobblestones of basalt are scattered on the surface. Content of gravel and cobblestones ranges from 15 to 25 percent in the A1 horizon and from 20 to 35 percent in the B2 horizon. The soils are usually moist but are dry above the hardpan for more than 60 consecutive days in summer. The indurated hardpan is immediately over basalt bedrock in most places.

In the A1 horizon, chroma ranges from 2 to 3. Thickness ranges from 7 to 8 inches. The A1 horizon is slightly calcareous or moderately calcareous. In the B2 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. This horizon is gravelly or cobbly heavy loam or gravelly or cobbly light clay loam. Reaction is moderately alkaline or strongly alkaline.

Snowville gravelly silt loam, 6 to 20 percent slopes (SrE).—This soil is on foot slopes and rolling hills in the northern part of Hansel Valley. Slopes are slightly convex and long. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Gemson silty clay loam, 6 to 10 percent slopes; Parleys silt loam, 10 to 20 percent slopes; Middle cobbly silt loam, 10 to 30 percent slopes; and Rock outcrop.

This soil is used for range, which is grazed by cattle and horses, and for wildlife habitat. Capability unit VIIs–U, nonirrigated; Upland Shallow Loam range site.

Sterling Series

The Sterling series consists of somewhat excessively drained soils. These soils are on alluvial fans, lake terraces, escarpments, and mountain foot slopes throughout the survey area. They formed in very gravelly and cobbly, calcareous alluvium, colluvium, and mixed lake sediments derived dominantly from limestone, dolomite, sandstone, and quartzite. Slopes range from 1 to 50 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, western wheatgrass, big sagebrush, Sandberg bluegrass, three-awn, cheatgrass, and annual weeds. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 120 to 150 days. Elevations range from 4,500 to 5,400 feet.

In a representative profile, the surface layer is grayish-brown and brown gravelly loam about 16 inches thick. The underlying layer is pale-brown cobbly loam to a depth of 27 inches and pale-brown very cobbly loam between depths of 27 and 60 inches or more. A layer of lime accumulation is at a depth of 16 inches. The surface layer is mildly alkaline and moderately calcareous, and the underlying layer is moderately alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is very rapid. Most roots penetrate to a depth of 28 to 38 inches in the soil. Only a few roots extend into the very gravelly or very cobbly material.

These soils are used mainly for range, but most of the more nearly level areas are used for nonirrigated crops. Some areas are used for urban development and as a source of gravel.

Representative profile of Sterling gravelly loam, 6 to 20 percent slopes, in range, 2,150 feet east and 700 feet north of the west quarter corner of section 21, T. 13 N., R. 7 W., in Hansel Valley:

A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, crumb structure; soft, friable, slightly sticky and slightly plastic; many fine roots; 25 percent gravel; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.

A12—2 to 8 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots; few very fine tubular pores; 25 percent gravel; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.

A13—8 to 16 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common fine and very fine tubular pores; 35 percent gravel and cobblestones; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.8); gradual, wavy boundary.

C1ca—16 to 27 inches, pale-brown (10YR 6/3) cobbly loam, brown (10YR 4/3) when moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots; common very fine and few tubular pores; 40 percent cobblestones and gravel, coated with lime; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.0); gradual, wavy boundary.

C2—27 to 60 inches, pale-brown (10YR 6/3) very cobbly light loam, yellowish brown (10YR 5/4) when moist; massive; soft, very friable, slightly sticky and nonplastic; few fine tubular pores; 70 percent cobblestones and gravel, coated with lime; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.0).

Depth to the horizon of carbonate accumulation ranges from 10 to 19 inches. Coarse fragments are rounded and angular limestone and sandstone, mainly gravel and cobblestones. The content of coarse fragments ranges from 20 to 50 percent in the A1 horizon and from 40 to 80 percent in the Cca and C horizons. Texture averages very gravelly or very cobbly light loam between depths of 10 to 40 inches. The soils are usually moist but are dry in all parts between depths of 8 to 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is gravelly loam or gravelly silt loam. Reaction is mildly alkaline or moderately alkaline. The A1 horizon is slightly calcareous or moderately calcareous and ranges from 10 to 19 inches in thickness.

In the Cca and C horizons, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; chroma ranges from 2 to 4. Reaction is moderately alkaline or strongly alkaline. Texture is gravelly loam, very gravelly loam, cobbly loam, or very cobbly loam. Very cobbly loamy sand may be present below a depth of 40 inches.

Sterling gravelly loam, 1 to 6 percent slopes (SsB).—This soil is on intermediate and high lake terraces and alluvial fans. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity before the moisture is depleted is 8 to 9 inches. Average annual precipitation ranges from 15 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 1 to 6 percent slopes, and Kearns silt loam, 3 to 6 percent slopes.

This Sterling soil is used for nonirrigated small grains. Capability unit IVs–U4, nonirrigated; range site not assigned.

Sterling gravelly loam, 6 to 20 percent slopes (SsD).—This soil is on long alluvial fans, intermediate and high lake terraces, and mountain foot slopes. Slopes are slightly convex. A profile of this soil is the one described as representative for the Sterling series. Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity before the moisture is depleted is 8 to 9 inches. Average annual precipitation ranges from 15 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

This soil is used for range, for nonirrigated small grains, and as a site for gravel pits. Capability unit IVs–U4, nonirrigated; Upland Stony Loam range site.

Sterling gravelly loam, 20 to 30 percent slopes (SsF).—This soil is on alluvial and colluvial fans, lake terraces, dissected escarpments, and mountain foot slopes. Slopes are short to medium in length. Runoff is rapid, and the hazard of erosion is high. Slight sheet and rill erosion is common, and a few shallow gullies have been formed. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 7 to 9 inches. Average annual precipitation ranges from 15 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes, and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

This soil is used mainly for range, but small, widely separated areas are used for nonirrigated small grains.

Capability unit VIs–U, nonirrigated; Upland Stony Loam range site.

Sterling gravelly loam, 30 to 50 percent slopes (SsG).—This soil is on alluvial and colluvial fans, terrace escarpments, and mountain foot slopes on the east side of Bear River valley in the vicinity of Deweyville. Runoff is rapid, and the hazard of erosion is high. Slight to moderate sheet and rill erosion is common, and a few gullies that are moderately deep have been formed. Available water holding capacity is 3.5 to 4 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 7 to 8 inches. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 130 to 150 days.

Included with this soil in mapping are small areas of Sterling gravelly loam, 20 to 30 percent slopes, and a few stony areas.

This soil is used for range. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Sterling very stony loam, 10 to 30 percent slopes (StE).—This soil is on alluvial fans along the base of the Wellsville Mountains near Deweyville. Slopes are medium in length and slightly convex. In places stones occupy as much as 3 percent of the surface. Runoff is rapid, and the hazard of erosion is high. Slight sheet erosion is common, and a few moderately deep gullies have been formed. Available water holding capacity is 3 to 4 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 7 to 8 inches. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 130 to 150 days.

Included with this soil in mapping are small areas of Sterling gravelly loam, 20 to 30 percent slopes, and Stony alluvial land.

This soil is used for range and urban development. Capability unit VIIs–U, nonirrigated; Upland Stony Loam range site.

Sterling-Parleys complex, 6 to 20 percent slopes (SuE).—This mapping unit is on high lake terraces, fans, terrace escarpments, and hilly uplands in the northern parts of Blue Creek valley and Hansel Valley. It consists of about 60 percent Sterling gravelly loam, 6 to 20 percent slopes, and 25 percent Parleys silt loam, 6 to 20 percent slopes. Included with these soils in mapping are areas of Pomat silt loam, 10 to 30 percent slopes, and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes. These included soils make up about 15 percent of the total acreage.

Soils of this complex are intermingled. The Sterling soil is on short, convex knolls and escarpments. The Parleys soil is in slightly concave areas between the knolls and ridges.

Runoff is rapid, and the hazard of erosion is high.

The soils of this conplex are used for nonirrigated small grains and range. Capability unit IVs–UZ, nonirrigated Upland Stony Loam range site.

Stingal Series

The Stingal series consists of well-drained soils. These soils are on lake terraces. They formed in strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone. Elevations range from 4,300 to 5,100 feet. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Russian-thistle, annual weeds, and some big sagebrush. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days.

In a representative profile, the surface layer is light brownish-gray loam about 6 inches thick. The subsoil is very pale brown loam about 19 inches thick. The substratum extends to a depth of 60 inches or more. It is very pale brown loam in the upper part and white loam and very fine sandy loam in the lower part. These soils are strongly alkaline or very strongly alkaline and are moderately calcareous or strongly calcareous throughout.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 7.5 to 9.5 inches to a depth of 5 feet. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted. Roots penetrate easily to a depth of 48 inches but may reach to a depth of 60 inches.

These soils have limited use for wildlife habitat and industrial development.

Representative profile of Stingal loam, 1 to 6 percent slopes, in a cultivated field, 1,800 feet east and 175 feet south of the northwest corner of section 4, T. 10 N., R. 7 W., about 5 miles west of Golden Spike National Monument:

Ap1—0 to 2 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.

Ap2—2 to 6 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, thick and medium, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

B21—6 to 13 inches, very pale brown (10YR 7/3) loam, brown (10YR 4/3) when moist; weak, coarse, prismatic structure that parts easily to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine tubular pores; moderately calcareous; strongly alkaline (pH 8.6); gradual, smooth boundary.

B22—13 to 25 inches, very pale brown (10YR 7/3) loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; common fine tubular pores; few krotovinas 10 to 15 millimeters in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); abrupt, irregular boundary.

C1ca—25 to 34 inches, very pale brown (10YR 8/3) loam, light brownish gray (2.5YR 6/2) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; common fine and few medium tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); abrupt, irregular boundary.

C2ca—34 to 48 inches, white (10YR 8/2) light loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, very friable, slightly sticky and nonplastic; few very fine roots; few very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); abrupt, wavy boundary.

C3ca—48 to 56 inches, white (2.5Y 8/2) very fine sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; strongly alkaline (pH 9.4); clear, smooth boundary.

C4—56 to 74 inches, white (2.5Y 8/2) very fine sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; soft, very friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4).

The solum ranges from 12 to 25 inches in thickness. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 15 to 18 percent.

In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is loam or very fine sandy loam. Reaction is moderately alkaline to very strongly alkaline.

In the B2 horizon value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is loam or silt loam and is moderately alkaline to very strongly alkaline and moderately calcareous or strongly calcareous. The B2 horizon ranges from 6 to 19 inches in thickness.

In the Cca and C horizons, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam, very fine loam, or fine sandy loam. Reaction is strongly alkaline to very strongly alkaline. The Cca and C horizons contain 10 to 30 percent fine gravel below a depth of 40 inches in places.

Stingal loam, 1 to 6 percent slopes (SvB).—This soil is on mainly south- and west-facing lake terraces. Slopes are medium in length and convex. A profile of this soil is the one described as representative for the Stingal series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes, Mellor silt loam, 1 to 6 percent slopes; and Windmill gravelly loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. In recent years large areas of crested wheatgrass have been planted on this soil. This soil also is used for range, wildlife habitat, and industrial development. Capability unit IVe–UZ, nonirrigated; Upland Loam range site.

Stingal loam, 6 to 10 percent slopes (SvD).—This soil is on lake terraces. Slopes are short and convex. Runoff is medium, and the hazard of erosion is moderate to high. Sheet and rill erosion is common. In places moderately deep gullies have been formed.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 6 to 10 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Stingal loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains and for range. Large areas of crested wheatgrass have been planted on this soil. Wildlife and industry also use this soil. Capability unit IVe–UZ, nonirrigated; range site not assigned.

Stokes Series

The Stokes series consists of moderately well drained soils that are affected by alkali. These soils are on low lake terraces and lake plains in Bear River valley southwest of Tremonton. They formed in fine-textured mixed lake sediments and alluvium. The surface has been reworked by wind or water and, in most places, is made up of many small hummocks or mounds. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is greasewood, big sagebrush, Nuttall saltbush, saltgrass, annual mustard, cheatgrass, and other annuals. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 130 to 150 days. Elevation ranges from 4,220 to 4,300 feet.

In a representative profile (fig. 11), the surface layer is light brownish-gray silt loam about 11 inches thick. The subsoil is light brownish-gray clay and white silty clay about 13 inches thick. The substratum is light-gray silty clay loam and very pale brown heavy silt loam; it reaches to a depth of 68 inches. The surface layer is moderately alkaline. Below the surface layer, and extending to a depth of 68 inches, the soil is very strongly alkaline. The surface layer is noncalcareous, and the subsoil and substratum are moderately calcareous to strongly calcareous. A layer of lime accumulation is at a depth of 18 inches.

Permeability is slow in the subsoil and is moderately slow in the substratum. The rate of water intake is slow. Because of the salt content, the water available to plants is only 7 to 10 inches to a depth of 5 feet and the water-supplying capacity is 9 to 11 inches before moisture is depleted. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to a depth of 5 feet. These soils are strongly affected by alkali. Most roots are in the upper 24 inches of soil, but some roots penetrate to a depth of 60 inches.

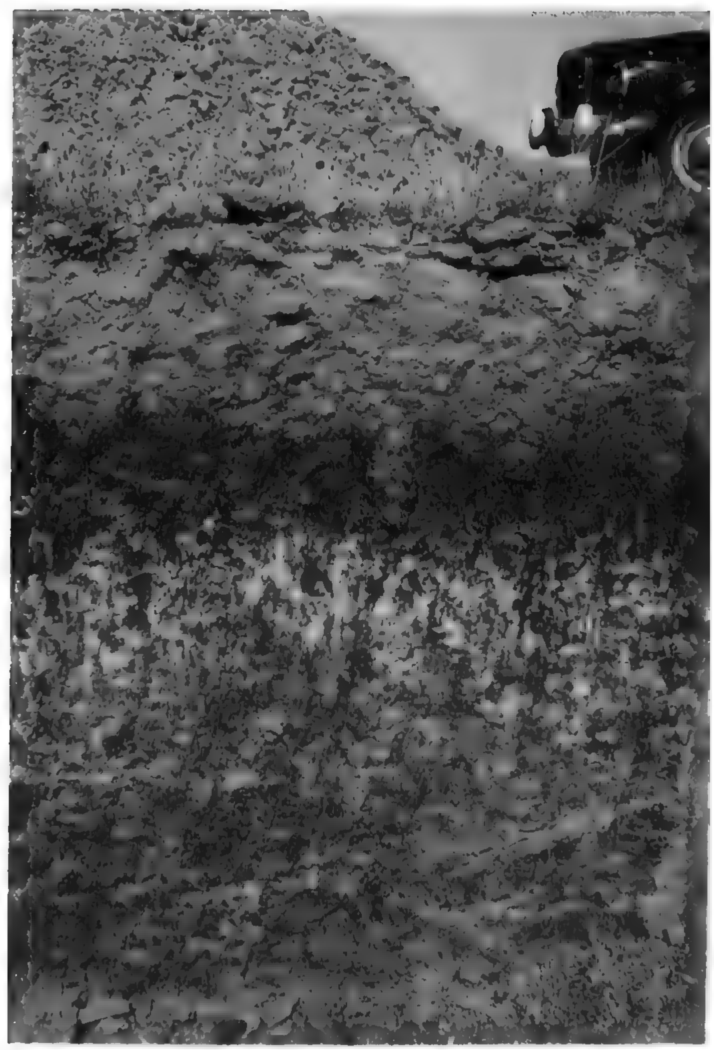

Figure 11.—Profile of Stokes silt loam.

Stokes soils are used for range, irrigated crops, and, to a lesser extent, nonirrigated crops.

Representative profile of Stokes silt loam, in a cultivated field, 2,450 feet west and 100 feet south of the east quarter corner of section 28, T. 10 N., R. 3 W., about 4 miles northwest from the town of Corinne:

Ap1—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine vesicular pores; moderately alkaline (pH 8.4); abrupt, smooth boundary.

Ap2—6 to 11 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine vesicular pores; moderately alkaline (pH 8.4); abrupt, smooth boundary.

B21t—11 to 18 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) when moist; strong, medium, prismatic structure; very hard, very firm, very sticky and plastic; few very fine roots; many very fine interstitial pores; continuous moderately thick clay films on ped faces; moderately calcareous, lime is disseminated; very strongly alkaline (pH 9.6); clear, wavy boundary.

B22tca—18 to 24 inches, white (10YR 8/2) silty clay, light brownish gray (2.5Y 6/2) when moist and pale-brown (10YR 6/3) ped faces when moist; common, fine, distinct, brown (10YR 5/3) and pale-olive (5Y 6/3) mottles; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few fine and very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6); gradual, wavy boundary.

C1ca—24 to 47 inches, light-gray (2.5Y 7/2) silty clay loam, pale olive (5Y 6/3) and olive (5Y 5/3) when moist; common, medium, prominent, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; many very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6); abrupt, smooth boundary.

C2—47 to 68 inches, very pale brown (10YR 7/3) heavy silt loam, pale olive (5Y 6/3) when moist; common, medium, prominent, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, friable, sticky and slightly plastic; many fine and very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 13 to 24 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, hue is 10YR or 2.5Y; chroma is 2 or 3. Texture is mainly silt loam but in places is light silty clay loam. The A1 horizon is moderately alkaline or strongly alkaline and is mostly noncalcareous but ranges to moderately calcareous. The A1 horizon ranges from 5 to 11 inches in thickness.

In the B2t horizon, hue is 10YR or 2.5Y; value ranges from 5 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is clay or silty clay, and the content of clay ranges from 40 to 55 percent. Structure ranges from weak to strong and is prismatic or subangular blocky. Clay films range from none or few to continuous and from moderately thick to thick on ped faces. Reaction is strongly alkaline or very strongly alkaline. The B21t horizon is slightly calcareous to moderately calcareous, but the B22tca horizon is strongly calcareous.

In the Cca and C horizons, hue is 7.5Y or 5Y; value ranges from 5 to 8 when the soils are dry and is 5 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silty clay, silty clay loam, or silt loam, and the C horizon is stratified with thin layers of very fine sandy loam. Mottles are common to many and distinct to prominent and are at a depth of 17 to 30 inches. In areas that have been drained, the water table is at a depth of 48 to more than 60 inches. Depth to the water table averages 40 inches where the soils have not been drained. These soils are strongly affected by alkali and are slightly to moderately affected by salts.

Stokes silt loam (Sw).—This soil is on low lake terraces and lake plains in the lower part of the Bear River valley, about 5 miles southwest of Tremonton. Slopes are 0 to 1 percent. Except where the soil has been leveled, the surface is uneven and is marked with many small mounds or hummocks. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Fridlo silt loam, moderately alkali, and Lasil silt loam, moderately alkali.

This Stokes soil is used mainly for irrigated crops and range. Irrigated crops are alfalfa, sugar beets, small grains, corn for silage, and irrigated pasture. Improved range is mostly tall wheatgrass. Some areas of this soil are used for nonirrigated small grains and for growing alfalfa seed. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Stony Alluvial Land

Stony alluvial land (Sx) is a miscellaneous land type that occurs at scattered locations along the Wasatch Mountains and the Promontory Mountains. It is on small alluvial fans and short breaks between lake terraces and consists of very stony, cobbly, and gravelly alluvium. The coarse fragments are mainly rounded or subrounded limestone or quartzite. Stones and cobblestones cover about 40 to 70 percent of the surface, and a few boulders are present. The vegetation is sparse but provides some grazing. It is mainly big sagebrush, maple, oakbrush, yellowbrush, chokecherry, sand dropseed, three-awn, and cheatgrass.

Stony alluvial land is used mainly for wildlife habitat and range. In places it is used for urban development. Capability unit VIIs-U, nonirrigated; Upland Stony Loam range site.

Sunset Series

The Sunset series consists of moderately well drained soils. These soils are on flood plains and low river terraces along the Bear River. They formed in mixed, medium-textured, stratified alluvium derived dominantly from limestone, sandstone, and quartzite rocks. Slopes range from 0 to 2 percent. The vegetation in noncultivated areas is mainly willow, rose, Great Basin wildrye, western wheatgrass, saltgrass, foxtail, povertyweed, cheatgrass, and annuals. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 12 to 16 inches, and the frost-free period is 125 to 145 days. Elevations range from 4,215 to 4,310 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 10 inches thick. Below this are layers of light brownish-gray heavy silt loam, dark-gray loam, grayish-brown light loam, light brownish-gray light loam and fine sandy loam, and pale-brown loamy fine sand. These extend to a depth of 60 inches or more. In the upper 15 inches, these soils are moderately alkaline and moderately calcareous. Between depths of 15 to 60 inches, they are strongly alkaline or very strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 8.5 to 10 inches to a depth of 5 feet. The water-supplying capacity is 10 to 12 inches before moisture is depleted. Roots penetrate to the water table, which is usually at a depth of between 30 and 40 inches. If the soils are drained, however, roots may penetrate to a depth of more than 60 inches.

Sunset soils are used for irrigated and nonirrigated crops.

Representative profile of Sunset silt loam, in a cultivated field, 1,400 feet north and 200 feet west from the south quarter corner of section 30, T. 10 N., R. 2 W., about 1½ miles north of Corinne:

Ap—0 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) when moist; weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; moderately calcareous; moderately alkaline (pH 8.0); abrupt, smooth boundary.

C1—10 to 15 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine tubular pores; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

A1b—15 to 19 inches, dark-gray (10YR 4/1) loam, very dark gray (10YR 3/1) when moist; moderate, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

C2—19 to 24 inches, grayish-brown (10YR 5/2) light loam, dark gray (10YR 4/1) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.

C3—24 to 33 inches, light brownish-gray (10YR 6/2) light loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, wavy boundary.

C4—33 to 38 inches, light brownish-gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tublar pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C5—38 to 60 inches, pale-brown (10YR 6/3) loamy fine sand, grayish brown (10YR 5/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; single grained; loose; few fine and very fine roots; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Texture averages loam between depths of 10 and 40 inches, but the soil at these depths is stratified with layers of fine sandy loam. Content of clay ranges from 15 to 18 percent. The soils are usually moist, and unlike most other soils in the survey area, in most years they are not dry in all parts between depths of 8 and 24 inches for as much as 60 consecutive days in summer. Mottles are at a depth below 34 to 38 inches and range from few to common and from fine to medium. Depth to the water table ranges from 30 to 40 inches unless the soils are drained. Most areas of these soils are nearly free of salt and alkali, but some areas are slightly to moderately affected.

In the A1 horizon, chroma is 1 or 2. This horizon is silt loam or loam. The content of organic matter decreases irregularly with depth. In the C horizon, value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 1 to 3.

Sunset silt loam (Sy).—This soil is along the Bear River on low river terraces and flood plains. Slopes are 0 to 2 percent, and the surface is uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight. This soil is subject to overflow and flooding early in spring in about 4 years out of 10.

Included with this soil in mapping are small areas of Kirkham silt loam and Martini fine sandy loam.

This Sunset soil is used mainly for irrigated alfalfa, small grains, sugar beets, corn for silage, and improved pasture. A small acreage is used for nonirrigated small grains. Capability unit IIw-2, irrigated; range site not assigned.

Syracuse Series

The Syracuse series consists of somewhat poorly drained soils. These soils are on low lake terraces and flood plains south of the Willard Bay Reservoir and extend northward to the town of Corinne. They formed in moderately coarse textured lake sediments and alluvium derived mainly from sandstone, quartzite, and limestone rocks. Slopes are mainly less than 1 percent. The vegetation in noncultivated areas is chiefly saltgrass, foxtail barley, alkali sacaton, greasewood, and annual weeds. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 12 to 17 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,215 to 4,275 feet.

In a representative profile, the surface layer is grayish-brown fine sandy loam about 16 inches thick. The underlying layer is light-gray fine sandy loam that reaches to a depth of 60 inches or more. The surface layer is noncalcareous and strongly alkaline. A layer of lime accumulation is at a depth of 16 inches. Below this, to a depth of 60 inches, the profile is moderately calcareous and strongly calcareous and is very strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 6.5 to 8.5 inches to a depth of 5 feet. Roots penetrate to the water table, which is commonly at a depth between 30 and 40 inches.

Syracuse soils are used for irrigated crops and range.

Representative profile of Syracuse fine sandy loam, in a cultivated field, 300 feet south and 1,000 feet west from the east quarter corner of section 9, T. 7 N., R. 2 W., about three-fourths of a mile northeast of the pumping plant at Willard Bay Reservoir:

Ap—0 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; few medium and large roots; strongly alkaline (pH 8.5); abrupt, smooth boundary.

A1—10 to 16 inches, grayish-brown (10YR 5/2) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few large and medium roots; strongly alkaline (pH 8.7); clear, smooth boundary.

C1ca—16 to 28 inches, light-gray (10YR 7/2) heavy fine sandy loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few medium and fine roots; few very fine tubular pores; moderately calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C2ca—28 to 48 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); diffuse, wavy boundary.

C3—48 to 60 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; many, medium and large, distinct, strong-brown (7.5YR 5/8) mottles; massive; soft, very friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7).

Texture averages fine sandy loam between depths of 10 and 40 inches. Depth to the horizon of carbonate accumulation ranges from 16 to 20 inches. The soils are usually moist, and unlike most other soils in the survey area, in most years they are not dry in all parts between depths of 8 and 24 inches for as much as 60 consecutive days in summer. Mottles are below a depth of 28 inches and range from common to many, from medium to large, and from faint to distinct. Most of the acreage has been drained, and the depth to water table is 40 to 60 inches or more. Where the soils are not drained, depth to water table is mainly 30 to 40 inches. The effect of salts and alkali is slight to moderate.

In the A1 horizon, chroma is 2 or 3. This horizon is fine sandy loam or sandy loam. Reaction is mildly alkaline to strongly alkaline. In the Cca and C horizons, value is 6 or 7 when the soils are dry and 5 to 6 when they are moist; chroma is 2 or 3. These horizons are strongly alkaline or very strongly alkaline and are moderately calcareous to strongly calcareous. In places the Cca horizon is weakly cemented.

Syracuse fine sandy loam (Sz).—This soil is on low lake terraces and flood plains. It is south of the Willard Bay Reservoir and extends northward to the town of Corinne. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. Soil blowing is common early in spring if the soil is unprotected.

Included with this soil in mapping are small areas of Gooch silt loam, Lewiston fine sandy loam, and Warm Springs fine sandy loam.

This Syracuse soil is used for irrigated crops and range. Irrigated crops are alfalfa, small grains, sugar beets, tomatoes, corn for silage, and irrigated pasture. Capability unit IIIw-2, irrigated; Alkali Bottom range site.

Thiokol Series

The Thiokol series consists of well-drained soils. These soils are on lake terraces. They formed in strongly calcareous, mixed lake sediments derived from limestone and sandstone. Slopes range from 0 to 10 percent. The vegetation in noncultivated areas is big sagebrush, bluebunch wheatgrass, squirreltail, winterfat, and annual grasses and weeds. Mean annual air temperature ranges from 45° to 50° F. Average annual precipitation ranges from 8 to 14 inches, and the frost-free period is 85 to 130 days. Elevations range from 4,300 to 5,125 feet.

In a representative profile (fig. 12), the surface layer and subsoil are light brownish-gray silt loam about 20 inches in total thickness. The substratum is white silt loam that reaches a depth of 60 inches or more. The soils are moderately calcareous and strongly alkaline to a depth of about 20 inches and are strongly calcareous and very strongly alkaline between depths of 20 inches and 60 inches or more.

Permeability is moderate, and the rate of water intake is high. Available water holding capacity is 10 to 12 inches

Figure 12.—**Profile of Thiokol silt loam, 1 to 6 percent slopes.**

to a depth of 5 feet. Roots penetrate to a depth of more than 60 inches.

These soils are used mainly for nonirrigated crops and range (fig. 13). Small areas are used for irrigated crops, wildlife habitat, and industrial development.

Representative profile of Thiokol silt loam, 1 to 6 percent slopes, in a cultivated field, 1,750 feet west and 1,500 feet north of the southeast corner of section 13, T. 13 N., R. 6 W., in Blue Creek valley:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; common fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8); abrupt, smooth boundary.

A1—5 to 9 inches, light, brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; common fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.7); gradual, wavy boundary.

B21—9 to 13 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine

Figure 13.—**Grassed waterway on Thiokol silt loam, 1 to 6 percent slopes, in Howell Valley.**

and very fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.7); gradual, wavy boundary.

B22—13 to 20 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and very fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8); gradual, wavy boundary.

C1ca—20 to 28 inches, white (10YR 8/2) heavy silt loam, pale brown (10YR 6/3) when moist; massive; very hard, friable, sticky and slightly plastic; few very fine roots; few very fine interstitial pores; strongly calcareous; very strongly alkaline (pH 9.4); gradual, wavy boundary.

C2ca—28 to 36 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, sticky and slightly plastic; few very fine interstitial pores; strongly calcareous; very strongly alkaline (pH 9.5); gradual, wavy boundary.

C3—36 to 60 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few very fine interstitial pores; strongly calcareous; very strongly alkaline (pH 9.7).

The solum ranges from 14 to 22 inches in thickness. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 19 to 24 percent.

In the A1 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry; chroma is 2 or 3. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is calcareous or moderately calcareous and ranges from 4 to 10 inches in thickness.

In the B2 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is silt loam or loam. Reaction is moderately alkaline or strongly alkaline. The B2 horizon is slightly calcareous or moderately calcareous and ranges from 4 to 12 inches in thickness.

In the Cca and C horizons, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam or very fine sandy loam. Reaction is strongly alkaline or very strongly alkaline. The Cca and C horizons are strongly calcareous or very strongly calcareous.

Thiokol silt loam, 0 to 1 percent slopes (ThA).—This soil is on lake terraces. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is

100 to 130 days. Runoff is slow, and the hazard of erosion is slight. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted.

Included with this soil in mapping are small areas of Thiokol silt loam, 1 to 6 percent slopes, and Hansel silt loam, 0 to 1 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife. Capability unit IVc–U, nonirrigated; range site not assigned.

Thiokol silt loam, 1 to 6 percent slopes (ThB).—This soil is on lake terraces. Slopes are slightly convex and long. A profile of this soil is the one described as representative for the Thiokol series. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days. Runoff is medium, and the hazard of erosion is moderate. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted.

Included with this soil in mapping are small areas of Thiokol silt loam, 6 to 10 percent slopes, and Hansel silt loam, 1 to 6 percent slopes.

This soil is used chiefly for nonirrigated small grains Some areas are used for wildlife and industrial developments. Capability unit IVe–UZ, nonirrigated; range site not assigned.

Thiokol silt loam, 6 to 10 percent slopes (ThD).—This soil is on lake terraces. Slopes are slightly convex and medium in length. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days. Runoff is medium, and the hazard of erosion is moderate. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted.

Included with this soil in mapping are small areas of Pomat silt loam, 10 to 30 percent slopes; Stingal silt loam, 6 to 10 percent slopes; and Kearns silt loam, 6 to 10 percent slopes.

This soil is used mainly for nonirrigated small grains Wildlife also use this soil. Capability unit IVe–UZ nonirrigated; range site not assigned.

Thiokol silt loam, low rainfall, 0 to 1 percent slopes (TkA).—This soil is on broad lake terraces. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 100 days. Runoff is slow, and the hazard of erosion is slight. The soil will supply 6 to 8 inches of water for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Bram silt loam and of Palisade silt loam, 1 to 6 percent slopes.

This Thiokol soil is used mainly for range. Limited areas are used for irrigated small grains, alfalfa, sugar beets, alfalfa seed, and irrigated pasture. Wildlife also use this soil. Capability unit IIIc–3, irrigated; capability unit VIIc–S, nonirrigated; Semidesert Loam range site.

Thiokol silt loam, low rainfall, 1 to 3 percent slopes (TkB).—This soil is on lake terraces. Slopes are medium in length. Average annual precipitation is 8 to 11 inches, and the frost-free period is 85 to 100 days. Runoff is medium, and the hazard of erosion is moderate. The soil will supply 6 to 8 inches of water for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Bram silt loam and of Mellor silt loam, 1 to 6 percent slopes.

This Thiokol soil is used mainly for range. Limited areas are used for irrigated small grains, alfalfa, alfalfa seed, and irrigated pasture. Some areas are used by wildlife. Capability unit IIIe–3, irrigated; capability unit VIIe–S, nonirrigated; Semidesert Loam range site.

Timpanogos Series

The Timpanogos series consists of well drained and moderately well drained soils. These soils are on lake terraces and alluvial fans. They formed in mixed lake sediments and local alluvium derived mainly from limestone, sandstone, and quartzite. Slopes range from 0 to 10 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, western wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 115 to 160 days. Elevations range from 4,250 to 5,175 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 17 inches thick. The subsoil is light brownish-gray and pale-brown heavy silt loam about 19 inches thick. The substratum is pale-brown and light yellowish-brown silt loam that extends to a depth of about 60 inches. The surface layer and upper part of the subsoil are mildly alkaline and noncalcareous. The lower part of the subsoil and the substratum are moderately alkaline and strongly alkaline and moderately calcareous and strongly calcareous. A layer of lime accumulation is at a depth of 32 inches.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Unless the soils are irrigated, the water-supplying capacity before moisture is depleted is 11 to 13 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated and irrigated crops.

Representative profile of Timpanogos silt loam, 1 to 6 percent slopes, in a cultivated field, 1,500 feet east and 500 feet north of the southeast corner of section 32, T. 14 N., R. 6 W., in the northern part of Blue Creek valley:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; few fine pores and few large pores; mildly alkaline (pH 7.8); abrupt, smooth boundary.

A1—6 to 17 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores and few medium pores; mildly alkaline (pH 7.7); clear, smooth boundary.

B2t—17 to 32 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; few fine and very fine roots; few fine pores and few medium pores; common thin clay films on ped faces; mildly alkaline (pH 7.7); clear, smooth boundary.

B3ca—32 to 36 inches, pale-brown (10YR 6/3) heavy silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few fine pores; moderately calcareous; moderately alkaline (pH 7.9); gradual, smooth boundary.

C1ca—36 to 44 inches, pale-brown (10YR 6/3) silt loam, brown (7.5YR 4/4) when moist; massive; very hard, friable, slightly sticky and plastic; few very fine roots;

few very fine pores; strongly calcareous; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2ca—44 to 60 inches, light yellowish-brown (10YR 6/4) silt loam, brown (7.5YR 4/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation ranges from 19 to 39 inches but depth of 28 to 34 inches is common. In places, some fine gravel is below a depth of 36 inches. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. This horizon is silt loam, loam, or very fine sandy loam and ranges from 7 to 17 inches in thickness. Reaction is mildly alkaline to moderately alkaline. The A1 horizon is generally noncalcareous but ranges to slightly calcareous where the soils are irrigated.

In the B2t horizon, hue is 7.5YR or 10YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture in the B2t horizon is heavy silt loam, loam, or light silty clay loam, and clay films range from few to continuous on ped faces. The B2t horizon is generally noncalcareous but ranges to moderately calcareous in the lower part. The horizon of carbonate accumulation in the B2t horizon is mildly alkaline or moderately alkaline.

In the Cca or C horizons, hue is 7.5YR or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is light silty clay loam, silt loam, very fine sandy loam, or loamy very fine sand. Reaction in the Cca or C horizons is moderately alkaline to very strongly alkaline. Depth to the water table ranges from 42 to 60 inches or more. In places, distinct mottles are below a depth of 40 inches.

Timpanogos loam, 0 to 3 percent slopes (TmA).—This soil is on low and intermediate lake terraces and alluvial fans in the Bear River valley south of Garland. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Fielding silt loam, warm; Kidman fine sandy loam, 0 to 2 percent slopes; and Parleys loam, 0 to 3 percent slopes.

This soil is used for irrigated sugar beets, tomatoes, alfalfa, small grains, corn, truck crops, and irrigated pasture. Capability unit I–1, irrigated; range site not assigned.

Timpanogos loam, 3 to 6 percent slopes (TmB).—This soil is on low and intermediate lake terraces and alluvial fans in the Bear River valley south of Garland and benchlands south of Brigham. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 18 inches. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kidman fine sandy loam, 2 to 4 percent slopes, and Parleys loam, 0 to 3 percent slopes. Also included are small areas of well drained to moderately well drained silt loam soils having slopes of 6 to 10 percent.

This soil is used for irrigated alfalfa, corn for silage, small grains, cherries, peaches, apples, apricots, and irrigated pasture. Capability unit IIe–1, irrigated; range site not assigned.

Timpanogos loam, cool, 0 to 3 percent slopes (TnA).—This soil is on broad, low and intermediate lake terraces and alluvial fans in the Bear River valley north of Garland. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 120 to 140 days.

Included with this soil in mapping are small areas of Fielding silt loam and Parleys loam, cool, 0 to 3 percent slopes.

This Timpanogos soil is used for irrigated alfalfa, sugar beets, corn for silage, small grains, and irrigated pasture. Capability unit IIc–2, irrigated; range site not assigned.

Timpanogos silt loam, 1 to 6 percent slopes (ToB).—This soil is on intermediate and high lake terraces and alluvial fans. Slopes are slightly convex and long. A profile of this soil is the one described as representative for the Timpanogos series. Runoff is medium, and the hazard of erosion is moderate. Average annual precipitation ranges from 15 to 17 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 3 to 6 percent slopes, and Parleys silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains and, to a limited extent, for wildlife habitat. Capability unit IIIe–U, nonirrigated; range site not assigned.

Timpanogos silt loam, 6 to 10 percent slopes (ToC).—This soil is on intermediate and high lake terraces and alluvial fans. Slopes are slightly convex and medium in length. Runoff is medium, and the hazard of erosion is moderate. Rill erosion is common, and a few shallow gullies have been formed. Average annual precipitation ranges from 15 to 27 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Hupp gravelly silt loam, 6 to 10 percent slopes; and Parleys silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains and for wildlife habitat. Capability unit IIIe–U, nonirrigated; range site not assigned.

Uffens Series

The Uffens series consists of well-drained soils that are affected by salts and alkali. These soils are on low lake plains and low lake terraces located entirely in the southwestern part of the survey area. They formed in strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone. Slopes range from 1 to 6 percent but are most commonly 1 to 2 percent. Vegetation consists of greasewood, pickleweed, kochia, shadscale, and annual mustard. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 6 to 8 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,225 to 4,350 feet.

In a representative profile, the surface layer is light brownish-gray silt loam about 3 inches thick. The subsoil is pale-brown silty clay loam about 15 inches thick. The substratum is light-gray light silt loam and white silty clay loam that reaches to a depth of 60 inches or more. The surface layer is strongly alkaline and moderately calcareous. The subsoil is strongly alkaline and very strongly alkaline and moderately calcareous. The substratum is moderately alkaline and strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is slow. Because of the high salt content, the water available to plants is only about 3 to 7 inches to a depth of 5 feet. If the soils are reclaimed, however, the available

water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of more than 60 inches, but most of them are in the top 18 inches of the soil.

These soils are used for range.

Representative profile of Uffens silt loam, in range, 200 feet west and 500 feet north of the southeast corner of section 18, T. 12 N., R. 10 W., about 4 miles northwest of Locomotive Springs Migratory National Wildlife Refuge headquarters:

A11—0 to 1 inch, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure that parts to moderate, very thin, platy; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine and fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

A12—1 to 3 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.9); abrupt, smooth boundary.

B21t—3 to 9 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate, fine and medium, prismatic structure that parts to moderate, fine, subangular blocky; hard, firm, sticky and plastic; common fine and very fine and few medium roots; many very fine vesicular pores; many thin clay films on ped faces; moderately calcareous; very strongly alkaline (pH 9.2); clear, wavy boundary.

B22t—9 to 18 inches, very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, very sticky and plastic; few very fine roots; common very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.5); clear, wavy boundary.

C1—18 to 30 inches, light-gray (2.5Y 7/2) light silt loam, olive gray (5Y 5/2) when moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few very fine vesicular pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); abrupt, wavy boundary.

C2—30 to 40 inches, white (2.5Y 8/2) light silty clay loam, light olive gray (5Y 6/2) when moist; massive; very hard, firm, sticky and slightly plastic; few very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.4); abrupt, wavy boundary.

C3—40 to 60 inches, white (2.5Y 8/2) silty clay loam, light olive gray (5Y 6/2) when moist; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5).

The solum ranges from 12 to 19 inches in thickness. Few or common prominent mottles are at a depth below 40 inches and in places are within 30 inches. Content of salts is as much as 1.25 percent in places. These soils are moderately or strongly affected by salts and alkali.

In the A1 horizon, hue is 10YR or 2.5Y; and value is 6 or 7 when the soils are dry. Texture is silt loam or light silt loam. Reaction is strongly alkaline or very strongly alkaline. The A1 horizon ranges from 2 to 4 inches in thickness.

In the B2t horizon, value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist. Texture is silty clay loam or light silty clay loam, and the content of clay ranges from 27 to 33 percent. The B2t horizon has none to many clay films on ped faces. Reaction is strongly alkaline to very strongly alkaline. The B2t horizon is moderately calcareous or strongly calcareous and ranges from 10 to 15 inches in thickness.

In the C horizon, hue ranges from 10YR to 5Y; value is 7 or 8 when the soils are dry and 5 or 6 when they are moist. Texture is silt loam or silty clay loam. Reaction is moderately alkaline or strongly alkaline.

Uffens silt loam (UF).—This soil is on broad, low lake plains and low lake terraces. It occurs only in the adjoining area north and west of the Locomotive Springs National Wildlife Refuge. Slopes are 1 to 6 percent but most commonly are less than 2 percent. Runoff is slow, and the hazard of erosion is slight. In places a few shallow gullies are present.

Included with this soil in mapping are small areas of Drum silt loam.

This Uffens soil is used for range. Capability unit VIIs–D8, nonirrigated; Desert Flats range site.

Very Stony Land

Very stony land (VS) is a miscellaneous land type that consists of areas that have about 80 to 90 percent of the surface covered by basalt stones. This land type is on terrace breaks and terrace escarpments in the southwest part of the survey area. The surface is covered by basalt stones about 1 to 6 feet in diameter. Vegetation consists of big sagebrush, bluebunch wheatgrass, squirreltail, yellowbrush, and cheatgrass.

Very stony land is used for wildlife habitat and very limited grazing. Capability unit VIIs–S, nonirrigated; Semidesert Shallow Loam range site.

Warm Springs Series

The Warms Springs series consists of somewhat poorly drained soils. These soils are on low lake terraces near Corinne and extend southward to the Weber County line. They formed in mixed lake sediments. Slopes are commonly less than 1 percent. The vegetation in noncultivated areas is mainly saltgrass, alkali sacaton, foxtail, wiregrass, and greasewood. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,215 to 4,225 feet.

In a representative profile, the surface layer is grayish-brown fine sandy loam and loam about 12 inches thick. Next is a layer of light brownish-gray, very pale brown, and light-gray loam and silt loam about 22 inches thick. Below this is light-gray fine sandy loam that extends to a depth of 60 inches or more. These soils are strongly alkaline or very strongly alkaline and are slightly calcareous to strongly calcareous throughout. A layer of lime accumulation is at a depth of 12 inches.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 8 to 10 inches to a depth of 5 feet. Roots penetrate to the water table, which is usually at a depth between 24 and 40 inches, but roots may extend to a depth of 60 inches or more if the soils are drained.

Warm Springs soils are used for irrigated crops and pasture.

Representative profile of Warm Springs fine sandy loam, in a cultivated field, 1,320 feet south of the north quarter corner of section 16, T. 9 N., R. 3 W., about 5 miles southwest of Corinne:

A11—0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; hard, friable, slightly sticky and plastic; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

A12—6 to 12 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine pores; slightly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.

C1ca—12 to 18 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine and few fine and medium pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); gradual, wavy boundary.

C2ca—18 to 30 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; few, fine, distinct, brown (7.5YR 4/4) mottles below a depth of 20 inches; massive; hard, friable, slightly sticky and plastic; many very fine and few fine and medium pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); clear, wavy boundary.

C3ca—30 to 34 inches, light-gray (10YR 7/2) light silt loam, pale brown (10YR 6/3) when moist; common, fine and medium, distinct, brown (7.5YR 4/4) mottles; massive; hard, friable, sticky and plastic; many very fine and few medium and fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); abrupt, wavy boundary.

C4—34 to 60 inches, light-gray (10YR 7/2) heavy fine sandy loam, brown (10YR 4/3) when moist; common, medium, prominent, yellowish-red (5YR 4/6) mottles; massive; soft, very friable, nonsticky and nonplastic; many very fine and few fine and medium pores; moderately calcareous; strongly alkaline (pH 9.0).

Between depths of 10 to 40 inches, the texture averages heavy fine sandy loam and content of clay ranges from 18 to 22 percent. Depth to the horizon of carbonate accumulation ranges from 10 to 22 inches. Depth to the water table is mainly between 24 and 40 inches where the soils are not drained. These soils are slightly affected by salts and alkali.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 1 or 2. Texture is fine sandy loam or light silt loam. The A1 horizon is strongly alkaline and ranges from 10 to 12 inches in thickness.

In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; chroma is 2 or 3. Reaction is strongly alkaline or very strongly alkaline. In places, lime-cemented nodules are present in this horizon. The Cca horizon ranges from 16 to 22 inches in thickness. In the C horizon, value is 7 or 8 when the soils are dry and ranges from 4 to 6 when they are moist; chroma ranges from 2 to 4. Reaction is strongly alkaline or very strongly alkaline.

Warm Springs fine sandy loam (Wa).—This soil is on low lake terraces. Slopes are less than 1 percent. Most of the acreage has been leveled and drained. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Fridlo silt loam, moderately alkali; Lewiston fine sandy loam; and Syracuse fine sandy loam.

This Warm Springs soil is used for irrigated crops and pasture. Irrigated crops are alfalfa, small grains, sugar beets, tomatoes, and corn for silage. Capability unit IIw-2, irrigated; Alkali Bottom range site.

Wasatch Series

The Wasatch series consists of somewhat excessively drained soils. These soils are on alluvial fans along the mountains near the town of Willard. They formed in alluvium derived from quartzite, gneiss, and schist. Slopes range from 3 to 25 percent. Vegetation is mainly sand dropseed, three-awn, big sagebrush, annual grasses, and weeds. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,275 to 5,200 feet.

In a representative profile, the surface layer is grayish-brown and brown gravelly sandy loam about 11 inches thick. The underlying layer extends to a depth of 60 inches or more and is brown gravelly loamy sand in the upper part and very gravelly loamy sand in the lower part. These soils are mildly alkaline throughout.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 3 to 3.75 inches, and the water-supplying capacity is 6 to 7 inches for plant growth before moisture is depleted. Roots are concentrated in the upper 24 to 30 inches of the soil but may penetrate to a depth of 60 inches or more.

Wasatch soils are used for irrigated crops, range, and wildlife habitat. These soils also are used as a source of fill material for roads, highways, and embankments.

Representative profile of Wasatch gravelly sandy loam, 3 to 10 percent slopes, in a cultivated field, 1,000 feet west and 500 feet north of the east quarter corner of section 11, T. 7 N., R. 2 W., south of Willard in White's orchard:

A11—0 to 1 inch, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure; soft, very friable, nonsticky and nonplastic; many fine roots; few medium pores; 20 percent gravel; mildly alkaline (pH 7.0); abrupt, smooth boundary.

A12—1 to 11 inches, brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots; few medium pores; 20 percent gravel; mildly alkaline (pH 7.6); gradual, wavy boundary.

C1—11 to 29 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 25 percent gravel; mildly alkaline (pH 7.5); gradual, wavy boundary.

C2—29 to 60 inches, brown (10YR 5/3) very gravelly sand, dark brown (10YR 3/3) when moist; single grained; loose; 55 percent gravel; mildly alkaline (pH 7.5).

Coarse fragments are dominantly gravel and cobblestones. Between depths of 10 and 40 inches, the texture averages gravelly coarse loamy sand and the content of coarse fragments is 25 to 35 percent. The soils are usually moist but are dry in all parts between depths of 12 and 35 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry; and chroma is 2 or 3. Texture is gravelly or cobbly sandy loam in the upper part of the A1 horizon, but it ranges to gravelly loamy sand that is 20 to 35 percent gravel or cobblestones in the lower part. Reaction is neutral or mildly alkaline. The A1 horizon ranges from 7 to 17 inches in thickness.

In the C horizon, hue is 10YR or 7.5YR; value is 4 or 5 when the soils are dry and 3 or 4 when they are moist; chroma ranges from 1 to 4. Texture is gravelly loamy sand, very gravelly loamy sand, very gravelly sand, cobbly sandy loam, or very cobbly loamy sand. Structure is weak, subangular blocky, or the horizon is single grained. Content of coarse fragments ranges from 25 to 80 percent. These fragments are gravel, cobblestones, and some stones.

Wasatch gravelly sandy loam, 3 to 10 percent slopes (WcC).—This soil is on alluvial fans at the base of mountains. A profile of this soil is the one described as representative for the Wasatch series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Francis loamy fine sand, 3 to 6 percent slopes; Kilburn gravelly sandy loam, 3 to 6 percent slopes; and Stony alluvial land.

This soil is used mainly for irrigated crops. Peaches, apricots, cherries, apples, alfalfa, tomatoes, melons, and small grains are the main crops grown. One area near Willard is used as a source of fill material for roads and embankments. Capability unit IVs-16, irrigated; range site not assigned.

Wasatch gravelly sandy loam, 10 to 25 percent slopes (WcE).—This soil is on alluvial fans at the base of mountains. The surface layer is 7 inches thick; hue in the lower layers is 10YR or 7.5YR; and chroma ranges from 1 to 4. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 10 to 20 percent slopes, and Stony alluvial land.

This soil is used mainly for range and wildlife habitat. A small area is used for irrigated peaches, apricots, and apples and includes small acreages of alfalfa-grass, melons, and small grains. Capability unit VIs-U, nonirrigated; Upland Sand range site.

Wasatch Series, Gravelly Subsoil Variant

The Wasatch series, gravelly subsoil variant, consists of excessively drained soils. These soils are on alluvial fans deposited in the receding waters of prehistoric Lake Bonneville near Brigham City. They formed in alluvium derived mainly from quartzite, gneiss, and schist. Slopes range from 10 to 70 percent. Vegetation consists of sand dropseed, three-awn, big sagebrush, annual grasses, and weeds. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,400 to 4,700 feet.

In a representative profile, the surface layer is dark grayish-brown gravelly sandy loam about 12 inches thick. Next is a layer of light yellowish-brown gravelly sandy loam about 9 inches thick. Below this is light-brown and light-gray very gravelly loamy sand that reaches to a depth of 60 inches or more. These soils are neutral throughout.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 2.5 to 3.5 inches, and the water-supplying capacity is about 5 inches of water for plant growth before moisture is depleted. Roots are concentrated in the top 18 inches of the soil, but some plant roots can penetrate to a depth of more than 50 inches.

These soils are commonly used as a commercial source of high-quality gravel and sand for making concrete.

Representative profile of Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes, in range, 4,400 feet east and 500 feet north of the southwest corner of section 19, T. 9 N., R. 1 W., east of Brigham City:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and very fine roots; 25 percent gravel; neutral (pH 7.0); gradual, wavy boundary.

C1—12 to 21 inches, light yellowish-brown (10YR 6/4) gravelly light sandy loam, dark yellowish brown (10YR 3/4) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; 35 percent gravel; neutral (pH 6.9); gradual, wavy boundary.

C2—21 to 35 inches, light-brown (10YR 7/1) very gravelly loamy sand, gray (10YR 6/1) when moist; single grained; loose; 75 percent gravel; neutral (pH 6.8); clear, wavy boundary.

C3—35 to 60 inches, light-gray (10YR 7/1) very gravelly loamy sand, gray (10YR 6/1) when moist; single grained; loose; 75 percent gravel; neutral.

Coarse fragments are mainly rounded gravel. Between depths of 10 and 40 inches, the texture averages gravelly or very gravelly loamy sand that is 50 to 55 percent gravel. The soils are usually moist but are dry in all parts between depths of 12 and 35 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Content of gravel ranges from 20 to 25 percent. In the C horizon, hue is 10YR or 7.5YR; value is 6 or 7 when the soils are dry; chroma ranges from 1 to 4. Texture ranges from gravelly light sandy loam to gravelly loamy sand in the upper part of the C horizon. Below a depth of 18 to 35 inches, the texture is very gravelly loamy sand that extends to a depth of 5 feet or more.

Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes (WdG).—This soil is on alluvial fans that have been deposited by the receding waters of prehistoric Lake Bonneville. A profile of this soil is the one described as representative for the Wasatch series, gravelly subsoil variant. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 30 to 60 percent slopes, and Kilburn gravelly sandy loam, 20 to 30 percent slopes.

This Wasatch soil is used mainly as a source of high-quality gravel and sand for making concrete. Capability unit VIIs-U, nonirrigated; Upland Sand range site.

Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes (WeE).—This soil is on alluvial fans at the base of mountains. The profile of this soil is similar to that described as representative for the Wasatch series, gravelly subsoil variant. The surface layer is cobbly sandy loam about 17 inches thick. The underlying layers range from cobbly sandy loam to very cobbly loamy sand. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Wasatch gravelly sandy loam, 10 to 25 percent slopes, and Stony alluvial land.

This soil is used for range and as a source of fill material for roads and embankments. Capability unit VIIs-U, nonirrigated; Upland Sand range site.

Wheelon Series

The Wheelon series consists of well-drained soils. These soils are on high lake terraces and terrace escarpments near the town of Beaver Dam. They formed in mixed lake sediments derived from light-colored tuff, tuffaceous sandstone, limestone, and conglomerate of the Salt Lake geologic formation. Slopes range from 6 to 60 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Indian ricegrass, balsamroot, and big sagebrush. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 120 to 130 days. Elevations range from 4,700 to 5,500 feet.

In a representative profile, the surface layer is light-gray silt loam about 6 inches thick. Next is a layer of white silt loam about 23 inches thick; this layer has a high accumulation of lime. Below this is white silt loam

to a depth of 60 inches or more. These soils are strongly alkaline and strongly calcareous throughout.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is 9 to 11 inches to a depth of 5 feet, and the water-supplying capacity is about 11 to 12 inches for plant growth before moisture is depleted. Roots are commonly concentrated in the top 30 to 36 inches of soil but may extend to a depth of more than 60 inches.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Wheelon silt loam, 10 to 30 percent slopes, in an area of Wheelon-Collinston silt loams, 10 to 30 percent slopes, in a cultivated field, 1,500 feet south and 1,050 feet west of the northeast corner of section 22, T. 12 N., R. 2 W., east of Collinston:

Ap—0 to 6 inches, light-gray (10YR 7/2) light silt loam, grayish brown (2.5Y 5/2) when moist; weak, thin and thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; strongly calcareous; strongly alkaline (pH 8.7); abrupt, smooth boundary.

C1ca—6 to 13 inches, white (2.5Y 8/2) silt loam, light gray (2.5Y 7/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.7); clear, wavy boundary.

C2ca—13 to 29 inches, white (5Y 8/2) silt loam, light gray (5Y 7/2) when moist; massive; extremely hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.7); diffuse, wavy boundary.

C3—29 to 60 inches, white (5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; massive; extremely hard, friable, slightly sticky and slightly plastic; strongly calcareous; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 6 to 18 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 18 to 25 percent. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, hue is 10YR or 2.5Y; value ranges from 6 to 7 when the soils are dry; chroma is 2 to 3. The A1 horizon is moderately calcareous or strongly calcareous and ranges from 6 to 18 inches in thickness.

In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; chroma is 2 or 3. Reaction is strongly alkaline or very strongly alkaline. The Cca horizon ranges from 11 to 23 inches in thickness. In the C horizon, chroma ranges from 1 to 3.

Wheelon silt loam, 30 to 60 percent slopes (WhG).—This soil is on high lake terraces and terrace escarpments. Runoff is very rapid, and the hazard of erosion is very high. Moderate to severe sheet and rill erosion is common.

Included with this soil in mapping are small areas of Wheelon silt loam, 10 to 30 percent slopes; Collinston silt loam, 10 to 30 percent slopes; and Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes.

This soil is used mainly for range. Some areas are used for wildlife habitat. Capability unit VIIe-U, nonirrigated; Upland Shallow Loam range site.

Wheelon-Collinston silt loams, 10 to 30 percent slopes (WmE).—This complex is on lake terraces and terrace escarpments in the vicinity of Beaver Dam. It consists of about 60 percent Wheelon silt loam, 10 to 30 percent slopes, and 30 percent Collinston silt loam, 10 to 30 percent slopes. Included with these soils in mapping are areas of Mendon silt loam, 6 to 10 percent slopes, and Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this complex are so closely intermingled that they cannot be separated at the scale used in mapping. The Wheelon soil has slightly concave slopes and is hilly; the Collinston soil has slightly concave slopes. Each of these soils has the profile described as representative for its respective series. Both soils are under a cover of mainly bluebunch wheatgrass, slender wheatgrass, Indian ricegrass, balsamroot, buckwheat, and big sagebrush. Runoff is rapid, and the hazard of erosion is high.

The soils of this complex are used for range and wildlife habitat, and some of the less sloping areas are used for nonirrigated small grains. Capability unit VIe-U, nonirrigated; Upland Shallow Loam range site.

Wheelon Series, Shallow Variant

The Wheelon series, shallow variant, consists of well-drained soils. These soils are on lake terraces, terrace escarpments, and mountain foot slopes. They formed in mixed lake sediments derived from light-colored tuffaceous sandstone, limestone, and conglomerate of the Salt Lake geologic formation. Slopes range from 20 to 60 percent. Vegetation is mainly bitterbrush, serviceberry, big sagebrush, mountainmahogany, bluebunch wheatgrass, Indian ricegrass, and scattered juniper. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation ranges from 15 to 18 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,880 to 6,000 feet.

In a representative profile, the surface is light brownish-gray gravelly silt loam about 10 inches thick. The underlying layer is very pale brown very cobbly silt loam that is about 9 inches thick over consolidated tuffaceous sandstone bedrock. A layer of lime accumulation is at a depth of 10 inches. The surface layer is moderately alkaline and moderately calcareous or strongly calcareous. The next layer is strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is moderate. Available water holding capacity is 1.5 to 2.5 inches for the soil above the consolidated tuff. The water-supplying capacity is about 4 to 5.5 inches for plant growth before moisture is depleted. Roots penetrate to the tuffaceous material.

These soils are used for range and wildlife habitat.

Representative profile of Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes, in range, 350 feet west and 3,100 feet north of the south quarter corner of section 5, T. 13 N., R. 2 W., about 3½ miles northeast of Plymouth:

A11—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft, very friable, slightly sticky and nonplastic; few fine and medium roots; 25 percent angular gravel; moderately calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.

A12—3 to 10 inches, light brownish-gray (10YR 6/2) gravelly light silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few fine and medium roots; 35 percent angular gravel and cobblestones; strongly calcareous; moderately alkaline (pH 8.4); abrupt, wavy boundary.

Cca—10 to 19 inches, very pale brown (10YR 8/3) very cobbly silt loam, pale brown (10YR 6/3) when moist; mas-

sive; slightly hard, very friable, slightly sticky and nonplastic; few fine and medium roots; 70 percent angular cobblestones and gravel; strongly calcareous; strongly alkaline (pH 9.0); abrupt, irregular boundary.

R—19 inches, consolidated tuffaceous sandstone.

A few stones are on the surface. Depth to consolidated tuff ranges from 15 to 20 inches. The soils are usually moist but are dry above the consolidated tuff for more than 90 consecutive days in summer.

In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is gravelly silt loam or gravelly very fine sandy loam, and content of gravel ranges from 20 to 35 percent. Reaction is mildly alkaline to strongly alkaline. The A1 horizon ranges from 8 to 10 inches in thickness.

In the Cca horizon, hue is 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 1 to 3. Texture is very gravelly or very cobbly silt loam or fine sandy loam, and content of cobblestones and gravel ranges from 55 to 80 percent. Reaction is mildly alkaline to strongly alkaline. The Cca horizon ranges from 7 to 10 inches in thickness.

Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes (WIG).—This soil is on south- and west-facing terrace escarpments and mountain foot slopes. Slopes are convex. Runoff is rapid, and the hazard of erosion is high.

Included with this soil in mapping are small areas of Wheelon silt loam, 30 to 60 percent slopes; Collinston silt loam, 10 to 30 percent slopes; and Middle cobbly silt loam, 30 to 70 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIIs-U, nonirrigated; Upland Shallow Loam range site.

Windmill Series

The Windmill series consists of well-drained soils. These soils are on alluvial fans, lake terraces, and offshore bars. They formed in mixed alluvium, reworked lake sediments, and beach deposits derived mainly from limestone rocks. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Sandberg bluegrass, sand dropseed, yellowbrush, big sagebrush, annual weeds, and some juniper in places. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,350 to 5,200 feet.

In a representative profile, the surface layer is dark grayish-brown and light brownish-gray gravelly loam about 10 inches thick. The subsoil is pale-brown gravelly loam about 7 inches thick. The substratum extends to a depth of more than 60 inches. It is pale-brown gravelly fine sandy loam in the upper part and light brownish-gray and grayish-brown loamy very fine sand in the lower part. These soils are strongly calcareous to very strongly calcareous throughout. The surface layer is moderately alkaline, and the subsoil and substratum are strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is 8 to 9 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches, but most roots are within a depth of 30 inches.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Windmill gravelly loam, 10 to 20 percent slopes, in range, 850 feet south and 675 feet west of the northwest corner of section 19, T. 10 N., R. 3 W., about 6 miles northwest of Corinne:

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and nonplastic; many fine and very fine roots; 30 percent fine gravel; strongly calcareous; moderately alkaline (pH 8.6); clear smooth boundary.

A12—4 to 10 inches, light brownish-gray (10YR 6/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, granular structure; slightly hard, very friable, slightly sticky and nonplastic; many fine and very fine roots; 30 percent fine gravel; strongly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

B2—10 to 17 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; 30 percent fine gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, smooth boundary.

C1—17 to 23 inches, pale-brown (10YR 6/3) gravelly fine sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; 30 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8. 7); gradual, wavy boundary.

C2—23 to 32 inches, light brownish-gray (10YR 6/2) gravelly loamy very fine sand, grayish brown (10YR 5/2) when moist; single grained; loose; few very fine roots; 40 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, smooth boundary.

C3—32 to 44 inches, light brownish-gray (10YR 6/2) gravelly loamy very fine sand, dark grayish brown (10YR 4/2) when moist; single grained; loose; 40 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, smooth boundary.

C4—44 to 60 inches, grayish-brown (10YR 5/2) gravelly loamy very fine sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose; 40 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the C horizon range from 12 to 21 inches. Fine gravel is on the surface and throughout the profile. Pebbles are ⅛ to ½ inch in diameter. Content of coarse fragments, which are mainly limestone, ranges from 20 to 50 percent and averages 40 percent. The soils are usually dry throughout. Texture averages gravelly sandy loam between depths of 10 and 40 inches.

In the A1 horizon, value ranges from 4 to 6 when the soils are dry and is 3 to 4 when they are moist; chroma is 2 or 3. Texture is gravelly loam or gravelly sandy loam. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is moderately calcareous or strongly calcareous and ranges from 3 to 11 inches in thickness.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. Texture is gravelly loam or gravelly sandy loam. Reaction is moderately alkaline or strongly alkaline. The B2 horizon is moderately calcareous to strongly calcareous and ranges from 5 to 11 inches in thickness.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 8 when the soils are dry and 3 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is gravelly fine sandy loam, gravelly loam, very loamy very fine sand, very gravelly loamy fine sand, or gravelly fine sand. In places, some cobblestones are below a depth of 25 inches. Reaction is strongly alkaline or very strongly alkaline. The C horizon is strongly calcareous to very strongly calcareous.

Windmill gravelly loam, 1 to 6 percent slopes (WnB).—This soil is on lake terraces and offshore bars. Slopes are

convex and medium in length. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes; Sterling gravelly loam, 1 to 6 percent slopes; and Stingal loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains, range, and wildlife habitat. Capability unit IVe–UZ, nonirrigated; Upland Loam range site.

Windmill gravelly loam, 6 to 10 percent slopes (WnD).—This soil is on dissected lake terraces, offshore bars, and alluvial fans. Slopes are convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate. Rill erosion is common, and shallow gullies have been formed in places.

Included with this soil in mapping are small areas of Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes; Sterling gravelly loam, 6 to 10 percent slopes; Stingal loam, 6 to 10 percent slopes; and Thiokol silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains, range, and wildlife habitat. Capability unit IVe–UZ, nonirrigated; Upland Loam range site.

Windmill gravelly loam, 10 to 20 percent slopes (WnE).—This soil is on dissected lake terraces, offshore bars, and fans. Slopes are convex and short to medium in length. A profile of this soil is the one described as representative for the Windmill series. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet erosion is common, and a few shallow to moderately deep gullies have been formed in places.

Included with this soil in mapping are small areas of Pomat silt loam, 10 to 30 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; and Stingal loam, 6 to 10 percent slopes.

This soil is used chiefly for range. A small acreage is used for nonirrigated small grains and for wildlife habitat. Capability unit VIe–U, nonirrigated; Upland Loam range site.

Woods Cross Series

The Woods Cross series consists of poorly drained soils. These soils are on flood plains and low terraces. They formed in noncalcareous alluvium and mixed lake sediments. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is wiregrass, sedges, saltgrass, Kentucky bluegrass, foxtail, willow, and teasel. Mean annual air temperature ranges from 46° to 50° F. Average annual precipitation ranges from 11 to 17 inches, and the frost-free period is 100 to 150 days. Elevations range from 4,220 to 4,550 feet.

In a representative profile, the surface layer is dark-gray silty clay loam about 24 inches thick. The underlying layer extends to a depth of 60 inches. It is light brownish-gray and light-gray silty clay loam that is stratified with thin layers of very fine sandy loam. These soils are mildly alkaline throughout.

Permeability is slow, and the rate of water intake is slow. Roots penetrate to the water table, which is generally at a depth of 30 inches, but if the soils are drained, roots can grow to a depth of more than 60 inches. Most roots are within a depth of 30 inches, but some are at a depth of more than 60 inches if the soils are drained and if the water table is lowered.

Woods Cross soils are used for meadow, pasture, and irrigated crops.

Representative profile of Woods Cross silty clay loam, in range, 700 feet north and 300 feet east of the southeast corner of section 25, T. 9 N., R. 2 W., about one-fourth mile south of Brigham City:

A11—0 to 10 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; very hard, firm, slightly sticky and plastic; many very fine and fine roots and common medium roots; mildly alkaline (pH 7.6); gradual, wavy boundary.

A12—10 to 24 inches, dark-gray (10YR 4/1) heavy silty clay loam, black (10YR 2/1) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles in lower part of horizon; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and very plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

C1g—24 to 34 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) when moist; many, medium, prominent, yellowish-red (5YR 5/8) mottles; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and very plastic; few fine roots; many very fine interstitial pores; mildly alkaline (pH 7.4); clear, smooth boundary.

C2g—34 to 37 inches, light-gray (2.5Y 7/2) heavy very fine sandy loam, grayish brown (2.5Y 5/2) when moist; many, medium, prominent, yellowish-red (5Y 5/8) mottles; massive; soft, very friable, slightly sticky and nonplastic; common very fine tubular pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

C3g—37 to 60 inches, light-gray (2.5Y 7/1) silty clay loam, grayish brown (2.5Y 5/2) when moist; many, medium, prominent, yellowish-red (5Y 5/8) mottles; massive; very hard, firm, sticky and very plastic; many very fine interstitial pores; mildly alkaline (pH 7.4).

Between depths of 10 and 40 inches, the texture averages heavy silty clay loam and the content of clay ranges from 35 to 40 percent. In places a peaty horizon, 1 to 6 inches thick, is on the surface.

In the A1 horizon, hue is 10YR or 2.5Y; value ranges from 3 to 5 when the soils are dry and is 2 or 3 when they are moist; and chroma is 1 or less. Texture is silty clay loam or light silty clay. Reaction is neutral or mildly alkaline. The A1 horizon ranges from 24 to 32 inches in thickness.

In the C horizon, hue is 2.5 to 5Y; value ranges from 5 to 7 when the soils are dry and from 2 to 5 when they are moist; and chroma is 2 or less. This horizon is silty clay loam or silty clay and is commonly stratified with thin layers of loam to very fine sandy loam. Reaction in the C horizon is mildly alkaline to moderately alkaline. Mottles are below a depth of 24 inches and range from few to many and from distinct to prominent. Depth to the water table ranges from 20 to 40 inches unless the soils are drained. In places these soils are moderately affected by salts.

Woods Cross silty clay loam (Wo).—This soil is on low lake terraces and flood plains. Slopes are slightly concave. A profile of this soil is the one described as representative for the Woods Cross series. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Average annual precipitation ranges from 13 to 17 inches, and the frost-free period is 130 to 150 days. Runoff is slow, and the hazard of erosion is none to slight. Available water holding capacity is 11 to 12 inches to a depth of 5 feet.

Included with this soil in mapping are small areas of James Canyon loam, 0 to 3 percent slopes; Logan silty clay loam; and Roshe Springs silt loam.

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This Woods Cross soil is used mainly for native pasture that is mowed for hay. A small area of this soil has been drained and is used for irrigated small grains and corn for silage. Capability unit IIIw-25, irrigated; Wet Meadow range site.

Woods Cross silty clay loam, moderately saline (Wr).—This soil is on flood plains and along stream channels in Howell Valley and Curlew Valley. The profile of this soil is similar to that described as representative for the Woods Cross series, but it is moderately affected by salts. Slopes range from 0 to 3 percent but most commonly are 0 to 1 percent. Average annual precipitation ranges from 11 to 13 inches, and the frost-free period is 100 to 130 days. Runoff is very slow, and the hazard of erosion is none. Because of the salt content, the water available to plants is only 7 to 9 inches to a depth of 5 feet. If the soil is reclaimed, however, the available water holding capacity is 11 to 12 inches to that depth.

Included with this soil in mapping are small areas of Logan silty clay loam.

This Woods Cross soil is used chiefly for native pasture. Where the soil is drained and reclaimed, it is used for irrigated small grains, alfalfa, corn for silage, sugar beets, and irrigated pasture. Capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Yeates Hollow Series

The Yeates Hollow series consists of well-drained soils. These soils are on mountain slopes and alluvial fans. They formed in alluvium, colluvium, and residuum derived mostly from sandstone and quartzite. Slopes range from 10 to 60 percent. Vegetation consists of bluebunch wheatgrass, big sagebrush, balsamroot, bearded wheatgrass, Great Basin wildrye, and annual grasses. Mean annual air temperature ranges from 40° to 44° F. Average annual precipitation ranges from 17 to 25 inches, and the frost-free period is 80 to 100 days. Elevations range from 5,200 to 7,000 feet.

In a representative profile, the surface layer is dark grayish-brown cobbly clay loam about 8 inches thick. The subsoil is dark grayish-brown cobbly silty clay in the upper 6 inches and brown very cobbly clay in the lower 18 inches. The substratum is brown very cobbly clay loam about 10 inches thick. Sandstone bedrock is at a depth of 42 inches. The soil is neutral throughout. Permeability is slow, and the rate of water intake is slow. Available water holding capacity is 5 to 7 inches to the bedrock. Roots penetrate to a depth of 4 or 5 feet or to bedrock.

Yeates Hollow soils are used for range, wildlife habitat, and water supply.

Representative profile of Yeates Hollow cobbly clay loam, 30 to 60 percent slopes, in range, 2,100 feet north and 600 feet east of the southwest corner of section 30, T. 14 N., R. 4 W., about 4 miles north of Whites Valley:

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) cobbly clay loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and very fine roots; few fine pores; 35 percent sandstone cobblestones; neutral (pH 6.8); clear, smooth boundary.

B21t—8 to 14 inches, dark grayish-brown (10YR 4/2) cobbly light silty clay, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; few fine and very fine pores; 45 percent sandstone cobblestones; few thin clay films on ped faces; neutral (pH 6.8); clear, smooth boundary.

B22t—14 to 19 inches, brown (10YR 4/3) very cobbly clay, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that parts to strong, medium, subangular blocky; very hard, firm, sticky and very plastic; few fine roots; few fine and medium pores; many moderately thick clay films on ped faces; 55 percent cobblestones; neutral (pH 7.0); gradual, wavy boundary.

B23t—19 to 32 inches, brown (7.5YR 5/4) very cobbly clay, reddish brown (5YR 4/4) when moist; moderate, medium to coarse, subangular blocky structure; extremely hard, firm, very sticky and very plastic; few very fine roots; few very fine pores; 70 percent cobblestones; continuous moderately thick clay films on ped faces; neutral (pH 7.3); gradual, wavy boundary.

C—32 to 42 inches, brown (7.5YR 5/4) very cobbly clay loam, reddish brown (5YR 4/4) when moist; massive; very hard, firm, sticky and plastic; few very fine roots; few very fine pores; 85 percent sandstone cobblestones and stones; few thin clay films on ped faces; neutral (pH 7.3); abrupt, irregular boundary.

R—42 inches, sandstone bedrock.

The solum ranges from 40 to 60 inches in thickness where it is underlain by bedrock or very cobbly or extremely stony and cobbly material. Stones, cobblestones, and gravel cover from 10 to 30 percent of the surface. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 to 90 consecutive days in summer.

In the A1 horizon, value ranges from 3 to 5 when the soils are dry and is 2 or 3 when they are moist; chroma is 2 or 3. This horizon is cobbly clay loam that is 20 to 40 percent cobblestones and gravel and is 0 to 3 percent stones. The A1 horizon ranges from medium acid to neutral and ranges from 7 to 14 inches in thickness.

In the B2t horizon, hue ranges from 10YR to 5YR; value ranges from 4 to 6 when the soils are dry; and chroma ranges from 2 or 6. Texture in the B2t horizon ranges from cobbly or gravelly to very cobbly or very gravelly clay or silty clay that averages more than 35 percent cobblestones, gravel, and stones throughout. Structure of the B2t horizon is prismatic, angular blocky, or subangular blocky. This horizon is medium acid to neutral, and it ranges from 18 to more than 34 inches in thickness. Clay films range from few to many and from thin to thick on ped faces.

In the C horizon, hue ranges from 10YR to 5YR. Texture is gravelly, cobbly, or very cobbly clay or clay loam. Content of gravel, cobblestones, and stones ranges from 25 to 85 percent.

Yeates Hollow cobbly clay loam, 20 to 30 percent slopes (YHE).—This soil is on mountains that are slightly convex. Runoff is slow, and the hazard of erosion is slight. The water-supplying capacity is 9 to 11 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Manila loam, 10 to 25 percent slopes, and Broad cobbly loam, 20 to 30 percent slopes.

This Yeates Hollow soil is used mainly for range, but some areas are used for water supply and wildlife habitat. Capability unit VIs-M, nonirrigated; Mountain Stony Loam range site.

Yeates Hollow cobbly clay loam, 30 to 60 percent slopes (YHG).—This soil is on mountains. A profile of this soil is the one described as representative for the Yeates Hollow series. Runoff is medium, and the hazard of erosion is moderate. The water-supplying capacity is 9 to 11 inches of water for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Broad cobbly loam, 30 to 60 percent slopes; Manila loam,

25 to 60 percent slopes; and Middle cobbly silt loam, 30 to 70 percent slopes.

This Yeates Hollow soil is most commonly used for range, but some areas are used for water supply and wildlife habitat. Capability unit VIIs–M, nonirrigated; Mountain Stony Loam range site.

Yeates Hollow-Goring association, steep (YRE).—This mapping unit is on alluvial fans and the mountains south of the town of Mantua. It consists of about 50 percent Yeates Hollow stony loam, 25 to 40 percent slopes, and 40 percent Goring clay loam, 25 to 40 percent slopes. Included with these soils in mapping are areas of Obray clay, 10 to 25 percent slopes; Goring clay loam, 10 to 25 percent slopes; and Yeates Hollow stony loam that has slopes of less than 25 percent. These included soils make up about 10 percent of the total acreage.

The soils of this association are intermingled in very steep areas having all aspects. Both soils are under a cover of bluebunch wheatgrass, slender wheatgrass, big sagebrush, mulesear dock, Great Basin wildrye, and annual grasses.

The profile of the Yeates Hollow soil is similar to that described as representative for the Yeates Hollow series, but the surface layer is stony loam. The water-supplying capacity of this soil is about 10 to 13 inches for plant growth before moisture is depleted. The profile of the Goring soil is similar to that described as representative for the Goring series. Runoff is medium on these soils, and the hazard of erosion is moderate.

The soils in this association are used for range, water supply, and wildlife habitat. The Yeates Hollow soil is in capability unit VIs–M, nonirrigated; Mountain Stony Loam range site. The Goring soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site.

Use and Management of the Soils

The soils of Box Elder County, Eastern Part, are used primarily for irrigated crops, irrigated pasture, nonirrigated crops, and range. This section discusses the use of the soils for these purposes and gives estimated yields of the principal crops. It also includes a discussion of the use of the soils for wildlife and for the building of roads, reservoirs, and other engineering works.

Use and Management of the Soils for Crops

Soils differ in their suitability for farming and in the management they require for continuous profitable crop production without soil deterioration. Soil management procedures can best be planned in detail according to the individual soils. Some management principles are beneficial, however, if applied to most of the soils used for the production of irrigated crops and pasture. This section consists of brief discussions of (1) general management practices that apply to irrigated soils; (2) general management practices that apply to nonirrigated soils; (3) capability groupings of soils; and (4) estimated yields.

General management for crops on irrigated soils

One important requirement for the management of irrigated soils is the safe and uniform distribution of irrigation water. Several methods of applying irrigation water will give good control. Before selecting the method, the farmer or rancher should consider the slope of the field; the kind of soil; the kind of crops to be grown, the depth at which the crops will root, and the amount of water they need; and the quantity and quality of the irrigation water supply.

Border and furrow irrigation are methods well suited to soils that have slopes of less than 3 percent. Furrows are used mainly for row crops and borders for close-growing crops. Very small furrows called corrugations are used in combination with borders to reduce crusting during the germination period. Corrugations also may be used for close-growing crops where slopes are as much as 10 percent. Losses of soil and water can be held to a minimum by using appropriate lengths of runs and size of streams in corrugations, furrows, and borders.

Sprinkler irrigation is well suited to most soils and crops. It is particularly well suited to gravelly and sandy soils and to soils that have steep or uneven slopes.

Land leveling is needed on many soils to facilitate the uniform distribution of water. Where deep cuts remove the original surface layer and expose limy, salty, or alkali soil material, heavy applications of organic matter will help to restore tilth and fertility.

Drainage and reclamation of wet and saline soils are needed for most crops. Special onsite studies are needed to assure the correct depth and frequency of drainage lines and to plan an irrigation system and soil treatments that assure successful removal of harmful salts and alkali and restore tilth and fertility to the soils (*11*).

Because of its beneficial effect on soil structure, the return of organic matter is particularly important in soils that are irrigated. Sources of organic matter are crop residue, barnyard manure, and the sod crops grown in the cropping system. Practices that provide for regular additions of organic matter are ordinarily the most beneficial. The use of fertilizer in amounts sufficient to produce large increases in plant growth makes it practicable to return increased amounts of organic matter.

The low content of organic matter in some soils of the survey area makes these soils especially susceptible to the formation of traffic or tillage pans. Good tilth can be maintained and the formation of tillage or traffic pans reduced, however, if the soils are not tilled or trampled when wet. The formation of tillage and traffic pans can also be reduced by varying the depth of tillage and by limiting the number of trips over the soils with tillage equipment.

Most of the soils of this area are well supplied with potassium, calcium, iron, and magnesium. Crops generally respond to a fertilizer that is high in content of nitrogen or phosphorus, or both, depending on the crop and the cropping history.

General management for crops on nonirrigated soils

Soil erosion and the limited available moisture are the main concerns associated with nonirrigated soils in this area. Conservation practices help to alleviate these concerns.

Managing crop residue in a way that leaves much of the stubble and other residue on or near the soil surface is effective for increasing water intake into the soil and reducing erosion. This cover of residue also helps to prevent surface sealing and reduces evaporation losses. Sweeps, chisels, and rod weeders are efficient tools for

managing residue. Nonleguminous crops commonly respond to nitrogen fertilizer where moisture limitations are not too severe.

Diversions and terraces are effective land-treatment measures for controlling erosion. Diversions placed near the upper part of the fields used for crops intercept runoff from higher ground, generally range. In this area of limited rainfall, diversions can usually intercept and store all the runoff water. Most diversions are built level and have at least partial blocks at the ends. Level terraces are spaced at intervals that will help keep soil losses within acceptable limits. The kind of soil and the slope mainly determine suitable spacing.

Contour farming in conjunction with terrace and diversion systems helps to reduce erosion and retain moisture on the land.

Capability grouping [3]

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations where used for field crops, the risk of damage where they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require very careful management, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that generally make them unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about the management of soils. Capability units are generally designated by adding numbers or numbers and letters assigned locally, for example, IVs–U4, VIIs–M, or VIIs–S8. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter immediately following the subclass indicates the kind of limitation as defined in the foregoing paragraph. The part of the symbol following the hyphen indentifies the capability unit in the State system; they are not numbered consecutively.

In the Utah system, a number or letter is used to suggest the chief kinds of limitation. The number 1, 2, or 3 in the first position shows the climate, as 1—climate with 140 to 180 frost-free days, 2—climate with 100 to 140 frost-free days, and 3—climate with 70 to 100 frost-free days.

The letters D, S, U, M, and H in the first position are for nonirrigated capability units and show the range of average annual precipitation. D (desert) is 6 to 8 inches, S (semidesert) is 8 to 12 inches, U (upland) is 12 to 16 inches, M (mountain) is 16 to 22 inches, and H (high mountain) is 22 to 35 inches or more. Additional numbers or letters are used to show limitations as follows:

2—overflow or inadequate surface drainage
3—inhibiting layer
4—low water holding capacity (gravelly or cobbly soils)
5—slow permeability

[3] ODAS R. AUSTIN and WENDALL K. PETTERSON, soil conservationists, Soil Conservation Service, helped prepare this section.

6—low water holding capacity (sandy soils)
8—alkali and salinity
X—coarse fragments on the surface
Z—inadequate moisture
E—erosion hazard
A—aspen
C—conifer
J—juniper

Management by capability units

In this subsection each capability unit in Box Elder County, Eastern Part, is described and the use and management are briefly discussed. The names of soil series represented are mentioned in the capability unit, but this does not mean that all the soils of a given series are in that unit. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I-1, IRRIGATED

This capability unit consists of well drained and moderately well drained soils. The surface layer is dominantly silt loam, loam, or fine sandy loam, but in places it is light silty clay loam. The underlying layers are silty clay loam and fine sandy loam. Slopes are 0 to 3 percent. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days. These soils are of the Fielding, Kidman, Millville, Parleys, and Timpanogos series.

The rate of water intake is slow to moderate, and permeability is moderately slow to moderate. Runoff is slow, and the hazard of erosion is none to slight. The available water holding capacity is 7.5 to 12 inches to a depth of 5 feet. Roots penetrate easily to a depth of 60 inches.

The soils in this unit are used for irrigated alfalfa, corn, small grains, sugar beets, tomatoes (fig. 14), truck crops, and improved pasture. Also, some areas are used for apples and peaches. In addition, these soils are used for wildlife habitat and urban development.

The soils in this unit are well suited to irrigation by both surface and sprinkler methods. Where surface methods of irrigation are used, land leveling to a uniform grade is commonly needed for efficient application of

Figure 14.—**Tomatoes being harvested on Kidman fine sandy loam, 0 to 1 percent slopes. This soil is in capability unit I–1, irrigated. Wellsville Mountains are in the background.**

irrigation water. Furrow and border methods of irrigation are well suited for row crops, and border irrigation is suited to alfalfa, small grain, and other close-growing crops.

Good tilth can be maintained if the soils are plowed in the fall and organic matter is regularly replaced by manure or crop residue. Crops generally respond to nitrogen, phosphorus, or both, but the degree of response depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIe-1, IRRIGATED

This capability unit consists of well drained and moderately well drained soils on lake terraces and alluvial fans. The surface layer and underlying layers are silt loam, loam, and fine sandy loam. Slopes are 2 to 6 percent. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days. These soils are of the Dagor, Kidman, Millville, and Timpanogos series.

The rate of water intake is moderate, and permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is 7.5 to 11 inches to a depth of 5 feet. Roots penetrate easily to a depth of 48 to 60 inches. The soils are mainly well drained, but some areas are moderately well drained and have a water table at a depth of about 50 to 60 inches.

These soils are used for irrigated alfalfa, corn, sugar beets, sweet corn, tomatoes, and some melons and peas. Adequately drained areas of these soils are well suited to apples, apricots, cherries, and peaches. Improved pasture is grown in rotation with other farm crops in some places.

The soils in this unit are well suited to irrigation. Because of the slope, erosion is a hazard on these soils. Care is needed in applying irrigation water. Where surface methods of irrigation are used, moderate measures for water control are needed to keep erosion to a minimum. Row crops generally are not surface irrigated on these soils where slopes exceed 3 percent. On slopes of less than 3 percent, surface methods of irrigation, such as furrows, corrugations, and borders, have proved satisfactory. These soils are well suited to sprinkler irrigation. Contour furrows are suitable for irrigation of orchards.

Good tilth is easily maintained by plowing in the fall, by returning organic matter, such as crop residue or manure, and by avoiding tilling or trampling in places where the soils are too wet. Crops generally respond to nitrogen, phosphorus, or both, but the degree of response depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIe-2, IRRIGATED

Kearns silt loam, 3 to 6 percent slopes, is the only soil in this capability unit. It is a well-drained soil on alluvial fans and terraces. The underlying layers are silt loam or loam. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 115 to 130 days.

The rate of water intake is moderate, and permeability is moderate. Runoff is slow, and the hazard of erosion is slight to moderate. The available water holding capacity is 10 to 11 inches to a depth of 5 feet. Roots penetrate easily to a depth of 60 inches. In some places the soil is very fine sandy loam below a depth of 48 inches. Most areas of this soil are small.

This Kearns soil is used for irrigated alfalfa, corn, and small grains. It is well suited to irrigation. Proper management of irrigation water is needed to obtain high production of crops. Some land leveling may be required to make possible the uniform application of irrigation water. Row crops generally are not surface irrigated on this soil. Close-growing crops of alfalfa, small grains, and improved pastures are normally irrigated by contour ditches and corrugations. This soil also is well suited to sprinkler irrigation.

Good tilth is easily maintained by plowing in the fall, by returning organic matter, such as manure or crop residue, and by avoiding tilling or trampling when the soil is too wet. Crops generally respond to nitrogen, phosphate, or both, but the degree of response depends on the kind of crop and the way the soil has been managed in the past.

CAPABILITY UNIT IIw-2, IRRIGATED

This capability unit consists of moderately well drained and somewhat poorly drained soils on low river terraces, flood plains, and alluvial fans. The surface layer is silt loam, loam, or fine sandy loam. The underlying layers are mainly silt loam to loamy fine sand but include some gravelly loam or gravelly sandy loam. Slopes are 0 to 4 percent but most commonly are 0 to 2 percent. Average annual precipitation ranges from 12 to 17 inches, and the frost-free period is 125 to 160 days. These soils are of the Draper, James Canyon, Lewiston, Martini, Millville, Sunset, and Warm Springs series.

The rate of water intake is moderate to rapid, and permeability is moderate to moderately rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The Martini and Sunset soils are subject to flooding and overflow in the spring, and streambank cutting is common in areas of these soils. The available water holding capacity is 6 to 12 inches to a depth of 5 feet. Depth to the water table fluctuates with the season but generally ranges from 20 to 50 inches, except where the soils are drained. In places, the soils of this unit are slightly to moderately affected by salts and alkali. The James Canyon soil generally is gravelly or sandy below a depth of 36 inches.

These soils are used mainly for irrigated alfalfa, corn, small grains, sugar beets, and improved pasture. Tomatoes and some melons are grown on the Draper and Millville soils where temperatures are slightly warmer than in other areas of soils in this unit. Isolated areas along the Bear River flood plain, where the water is not pumped or diverted, are used for nonirrigated small grains. Some of these soils are used for irrigated native pasture that is grazed or cut for hay.

The main management practices needed on these soils are drainage and water table control. Open drains and tile drains commonly are used, but in many places they are not deep enough or they are clogged and do not function well. Special onsite investigation is needed to determine the best and most economical drainage system. Land leveling is needed if surface irrigation water is to be applied evenly. Row crops are irrigated by borders and furrows, and close-growing crops normally are irrigated by the border method.

Good tilth is maintained easily by plowing in the fall, by applying organic matter, such as manure or crop residue, and by avoiding trampling or tilling when the soils are wet. Crops grown on these soils respond well to nitrogen, phosphorus, or both. The response to fertilizer depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIc-2, IRRIGATED

This capability unit consists of well drained and moderately well drained soils on lake terraces and alluvial fans. The surface layer is silt loam or loam. The underlying layers generally range from silty clay loam to silt loam but, in some places, are very fine sandy loam below a depth of 40 inches. Slopes are 0 to 3 percent. Average annual precipitation ranges from 12 to 17 inches, and the frost-free period is 100 to 140 days. These soils are of the Fielding, Hansel, Kearns, Parleys, Red Rock, and Timpanogos series.

The rate of water intake is moderate, and permeability is moderately slow or moderate. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots penetrate mainly to a depth of 60 inches. The moderately well drained soils may have a water table at a depth of about 42 to 60 inches.

The soils in this unit are used for irrigated alfalfa, corn for silage, small grains, sugar beets, and improved pasture.

These soils have some climatic limitations because of the cool temperatures that restrict the growing of some crops, such as tomatoes.

These soils are well suited to irrigation by both surface and sprinkler methods. Where surface irrigation methods are used, land leveling to a planned grade generally is required if irrigation water is to be applied evenly. Furrow and border methods of irrigation are well suited to row crops, and border irrigation is suited to alfalfa, small grains, and other close-growing crops.

Good tilth can be maintained by plowing the soils in the fall and by replacing organic matter regularly with manure or crop residue. Crops generally respond to nitrogen, phosphorus, or both. The response to fertilizer depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIIe-16, IRRIGATED

This capability unit consists of somewhat excessively drained soils on alluvial fans and terraces south of Brigham City. The surface layer is loamy fine sand or gravelly sandy loam. The underlying layers range from loamy sand or gravelly sandy loam to very gravelly loamy sand. Slopes are 3 to 6 percent. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days. These soils are of the Francis and Kilburn series.

The rate of water intake is very rapid, and permeability is rapid. Runoff is slow, and the hazard of erosion is slight to moderate. Soil blowing is a slight to moderate hazard on the Francis soil if it is left unprotected. The available water holding capacity is 4 or 5 inches to a depth of 5 feet. Roots penetrate easily to a depth of 48 to 60 inches.

The soils in this unit are used mainly for irrigated crops, but some areas are used for urban development. These soils generally are well suited to apples, apricots, peaches, cherries, melons, small grains, improved pasture, and grass-legume hay. A small area of these soils is in Mantua Valley, however, where the crops grown are limited to small grains, alfalfa, and grass-legume hay.

Management practices are needed to control soil blowing and water erosion on these soils because of the slopes and the coarse-textured surface layer. Where surface methods of irrigation are used, intensive practices are needed for controlling the water. These soils are well suited to sprinkler irrigation. Spring plowing and the use of crop residue or a cover crop help to reduce soil blowing during the periods when a crop is not grown. Light, frequent irrigations are more efficient because the available water holding capacity of these soils is low. Large applications of fertilizers are neeeded for above-average growth of crops. Nitrogen is needed every year for most crops, and phosphorus is needed every 2 to 4 years, depending on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIIe-3, IRRIGATED

This capability unit consists of well-drained soils. The surface layer is silt loam, and the underlying layers are silt loam, loam, or very fine sandy loam. Slopes are 1 to 6 percent but most commonly are 1 to 2 percent. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 100 days. These soils are of the Palisade and Thiokol series.

The rate of water intake is moderate, and permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is 8 to 12 inches to a depth of 5 feet. Roots penetrate to a depth of 60 inches, but most roots are in the top 30 to 40 inches of the soil.

The soils in this unit are used mainly for irrigated alfalfa, small grains, and irrigated pasture. The acreage of this unit is very small and is entirely in the area west of the town of Snowville. The soils are irrigated by pump wells.

The main management practice needed on these soils is the control of erosion. Where surface methods of irrigation are used, intensive measures of water control are needed to attain efficient application of irrigation water. These soils are well suited to sprinkler irrigation. They are very friable and are easy to till, and only minimum tillage is required for their cultivation. The surface layer needs to be protected from erosion by vegetation or crop residue during periods of nonuse. Crop residue should be kept on or near the surface to reduce erosion and crusting of the surface soil.

Crops on these soils respond well to fertilizers. The degree of response depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIIw-2, IRRIGATED

This capability unit consists of poorly drained and somewhat poorly drained soils on lake terraces and flood plains. The surface layer and underlying layers are silt loam or fine sandy loam. Slopes are 0 to 3 percent but are commonly less than 1 percent. Average annual precipitation ranges from 12 to 17 inches, and the frost-free period is 140 to 150 days. These soils are of the Roshe Springs and Syracuse series.

The rate of water intake is moderate to rapid, and permeability is moderate to moderately rapid. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity, to a depth of 5 feet, is 10 to 11

inches for the Roshe Springs soils and 6.5 to 8.5 inches for the Syracuse soils.

Depth of the water table is mainly 30 to 40 inches for the Syracuse soils, unless the soils are drained, and is generally less than 20 inches for the Roshe Springs soils. The Syracuse soils are slightly to moderately affected by salts and alkali.

The soils in this unit are used for irrigated crops and native pasture. The principal crops grown are corn for silage, small grains, sugar beets, and tomatoes. Alfalfa and improved pasture are grown in rotation with other crops. Most areas of the Roshe Springs soils are in native pasture that is grazed or cut for hay.

The main management practices needed on these soils are drainage, land leveling, and proper irrigation methods. Open ditches and tile are used for draining, but special investigations are needed to determine the best and most economical drainage system. Soils affected by salts and alkali are benefited by an occasional leaching with irrigation water. Border and furrow irrigation methods are commonly used for irrigating these soils.

Because their available water holding capacity is limited, the Syracuse soils of this unit require light, frequent irrigations. These soils are sandy and are subject to soil blowing if left unprotected during periods of nonuse. Soil blowing early in spring is common on the Syracuse soils. Spring plowing and the use of such tillage implements as the sand packer are helpful in preparing a seedbed that is firm but has enough clods on the surface to minimize soil blowing. Maintaining the organic-matter content is also important. This may be accomplished through the use of barnyard manure, crop residue, and cover crops.

The Roshe Springs soils have good available water holding capacity and are not subject to soil blowing. These soils are suited to fall plowing and normal tillage practices.

Crops generally respond to nitrogen, phosphorus, or both, but the degree of response depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIIw-25, IRRIGATED

This capability unit consists of moderately well drained to poorly drained soils on low lake terraces and lake plains. The surface layer is silty clay loam or silt loam, and the underlying layers are clay, silty clay, or heavy silty clay loam. Slopes are 0 to 3 percent but most commonly are 0 to 1 percent. Average annual precipitation ranges from 12 to 17 inches, and the frost-free period is 130 to 150 days. These soils are of the Collett, Greenson, Honeyville, Logan, and Woods Cross series.

The rate of water intake is slow to moderate, and permeability is slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. These soils have been drained in most places. Where the soils are not drained, the depth to the water table is more than 30 inches, except for the Logan soils, where the depth to the water table is normally between 15 and 36 inches, and for the Wood Cross soils where it is between 20 to 30 inches.

Most areas of the soils in this unit have been drained and are used for irrigated corn, small grains, sugar beets, tomatoes, improved pasture, and alfalfa. Some areas are in irrigated native pasture that is grazed or cut for hay.

Drainage or control of the water table and control of irrigation water are the main management practices needed on these soils. The soils have severe water table or drainage limitations because of the fine texture and slow permeability of the underlying layers and the limited depth of drainage outlets. Tile drains are installed in most areas of these soils to control the water table. Special drainage investigations are generally needed so that placement of drains is economical. Land smoothing is needed to obtain uniform distribution or irrigation water. The border method of irrigation is better suited to alfalfa, small grains, and other close-growing crops than other methods of irrigation.

Where the surface layer is silt loam, it is easy to till, but where it is silty clay loam, it is difficult to till and is compacted if cultivated when wet. Good tilth can be maintained by plowing the soils in the fall and turning under crop residue. To maintain soil tilth, grazing and tillage should be avoided when the soils are wet.

A suitable cropping system is alfalfa-grass hay for 3 years, corn for silage for 1 year, sugar beets for 1 year, and small grains or truck crops for 1 or 2 years.

All crops except legumes respond to nitrogen fertilizer, and all crops respond to phosphorus.

CAPABILITY UNIT IIIw-28, IRRIGATED

This capability unit consists of moderately well drained and somewhat poorly drained soils on lake plains and low lake terraces. The surface layer is silt loam. The underlying layers are mainly silty clay loam or silt loam but range to sandy loam. Slopes are 0 to 1 percent. Average annual precipitation ranges from 8 to 16 inches, and the frost-free period is 100 to 150 days. These soils are of the Airport, Bram, and Fridlo series.

The rate of water intake is slow to moderate, and permeability is slow to moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity in reclaimed areas is about 8 to 12 inches to a depth of 5 feet. Roots penetrate mainly to a depth of 30 to 40 inches. Depth to the water table fluctuates with the season but normally is between 26 and 60 inches. These soils are slightly affected by salts and slightly to moderately affected by alkali.

Most areas of the soils in this unit have been drained, reclaimed, and leveled. They are used for irrigated alfalfa, corn for silage, sugar beets, tomatoes, and improved pasture. Some areas are used for native pasture that is either grazed or cut for hay.

Draining these soils, reclaiming them from salts and alkali, and controlling the water table are the main management practices. Open and tile drains are commonly used. Special onsite investigations are needed for economical drainage. Land leveling also is needed so that irrigation water can be distributed evenly. These soils require leaching with good-quality irrigation water at the beginning of reclamation and, if possible, once each year thereafter to maintain a low concentration of salt. Border and furrow methods of irrigation are well suited to these soils.

Keeping these soils in good tilth is difficult. Good tilth can be maintained by plowing in the fall and by avoiding tilling or trampling when the soils are wet. Adding barnyard manure and plowing under green-manure crops and other crop residue will help to improve the tilth.

Crops generally respond well to applications of nitrogen, phosphorus, or both. The degree of response depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IIIs-16, IRRIGATED

Kilburn gravelly loam, 1 to 3 percent slopes, is the only soil in this capability unit. It is a somewhat excessively drained soil on alluvial fans. The underlying layers are very gravelly sandy loam and loamy sand. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days.

The rate of water intake is very rapid, and permeability is rapid. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 4 to 5 inches to a depth of 5 feet. Roots penetrate easily to a depth of more than 60 inches.

The soil in this unit is used for irrigated crops. The main crops grown are cherries, peaches, apricots, apples, alfalfa, melons, corn, and small grains. A small acreage of this unit is in Mantua Valley, however, and is restricted to the growing of alfalfa, small grains, and irrigated pasture.

The main management practice needed is the efficient use of irrigation water. Because the available water holding capacity is low, applications of irrigation water should be light and frequent. This soil is well suited to sprinkler irrigation, but where the soil has been leveled, border and furrow methods of irrigation are suitable. Orchards normally are irrigated by contour ditches.

Also, the use of barnyard manure, crop residue, and cover crops is needed to maintain the content of organic matter of this soil. Large applications of fertilizers are needed to maintain above-average growth of crops. Nitrogen is needed on orchards. Good response also is obtained by applying both nitrogen and phosphorus fertilizers on most other crops. The degree of response depends on the kind of crop and the way the soil has been managed in the past.

CAPABILITY UNIT IIIc-3, IRRIGATED

Thiokol silt loam, low rainfall, 0 to 1 percent slopes, is the only soil in this capability unit. It is a well-drained soil on lake terraces. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 100 days.

The rate of water intake is moderate, and permeability is moderate. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots penetrate easily to a depth of 60 inches.

This soil is used for irrigated alfalfa, small grains, irrigated pasture, and alfalfa seed. The primary source of water is from pump wells.

The main factor in the successful management of this soil is the limited growing season. The soil is well suited to irrigation both by surface and sprinkler methods. Where surface methods of irrigation are used, land leveling to a planned grade generally is required so that irrigation water can be applied evenly. Furrow and border methods of irrigation are well suited to row crops, and border irrigation is well suited to alfalfa, small grains, and other close-growing crops.

Good tilth can be maintained by using minimum tillage practices and by replacing organic matter regularly through the use of manure or crop residue. Because of the strong winds in areas of this soil, crop residue should be maintained on the soil surface. Crops generally respond to nitrogen, phosphorus, or both. The degree of response depends on the kind of crop and the way the soil has been managed in the past.

CAPABILITY UNIT IVe-16, IRRIGATED

This capability unit consists of somewhat excessively drained soils on alluvial fans. The surface layer is gravelly sandy loam, and the underlying layers are very gravelly sandy loam and very gravelly loamy sand. Slopes are 6 to 20 percent. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days. These soils are of the Kilburn series.

The rate of water intake is very rapid, and permeability is rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is 4 to 5 inches to a depth of 5 feet. Roots extend to a depth of more than 60 inches.

The soils in this unit are used mainly for irrigated stone fruits, apples, melons, grapes, alfalfa, tomatoes, small grains, grass-legume hay, and wildlife habitat.

The main management practices needed are the control of erosion and the efficient use of water. The soils are generally too steep for surface irrigation, except where irrigation is on the contour or across the slope. If surface methods are used, intensive management is needed to control irrigation water. Sprinkler irrigation is well suited to these soils. Because of the low available water holding capacity, light, frequent applications of irrigation water are most efficient.

The use of manure, crop residue, and cover crops to maintain the content of organic matter is important in maintaining the tilth of these gravelly soils. Large applications of fertilizer are needed to maintain above-average growth of crops. Nitrogen is needed on orchards and improved pasture every year. Phosphorus is needed on improved pasture every 2 or 3 years. Response to fertilizer largely depends on the kind of crop and the way the soils have been managed in the past.

CAPABILITY UNIT IVs-16, IRRIGATED

Wasatch gravelly sandy loam, 3 to 10 percent slopes, is the only soil in this capability unit. It is a somewhat excessively drained soil on alluvial fans along the mountain front near Willard. The underlying layers are gravelly loamy sand and very gravelly sand. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 150 days.

The rate of water intake is very rapid, and permeability is rapid. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 3.0 to 3.75 inches to a depth of 5 feet. Most roots penetrate to a depth of 24 to 30 inches, but some roots penetrate to a depth of more than 60 inches.

This soil is used for irrigated crops. The main crops grown are peaches, apricots, apples, cherries, alfalfa, tomatoes, melons, and small grains. This soil is also used as a source of fill material for roads and embankments.

The use of manure, crop residue, and cover crops to maintain the content of organic matter is important in maintaining the tilth of this gravelly soil. Most crops respond well to frequent applications of fertilizer, but

the degree of response depends on the kind of crop and the way the soil has been used in the past.

CAPABILITY UNIT IVw-28, IRRIGATED

This capability unit consists of poorly drained, somewhat poorly drained, and moderately well drained soils on lake terraces and flood plains. The surface layer is mainly silt loam, and the underlying layers range from silty clay or silty clay loam to very fine sandy loam. Slopes are 0 to 3 percent but most commonly are 0 to 1 percent. Average annual precipitation ranges from 11 to 17 inches, and the frost-free period is 120 to 155 days. These soils are of the Airport, Cudahy, Fridlo, Greenson, Kirkham, Lasil, Magna, and Stokes series.

The soils in this unit are slightly to moderately affected by salts. Generally, they are slightly to moderately affected by alkali, but the Cudahy soils are not affected by alkali. The rate of water intake is slow to moderate in the soils of this unit, and permeability is very slow to moderate. Runoff is slow to very slow or ponded, and the hazard of erosion is none to slight. Because of the salt content, the water available to plants is 3 to 10 inches. If the soils are reclaimed, however, the available water holding capacity is 8 to 12 inches to a depth of 5 feet, except in the Cudahy soils, which have a lime hardpan at a depth of 23 to 40 inches and can hold 4 to 6 inches of available water above the hardpan. Roots extend mainly to a depth of 30 to 40 inches.

Depth to the water table fluctuates with the season but ranges from 18 to 48 inches in areas that are not drained. The Kirkham soils are on the flood plains along the Malad and Bear Rivers, where they are subject to flooding and overflow and have a water table at or near the surface for many weeks in the spring.

The soils in this unit are used for irrigated crops and pasture. Where these soils are drained and partially reclaimed from salts and alkali, they are used for alfalfa, corn for silage, small grains, and sugar beets. Some of the pasture areas have been seeded to tall wheatgrass. These soils also are used for native pasture that is either grazed or cut for hay.

CAPABILITY UNIT IIe-M, NONIRRIGATED

This capability unit consists of well-drained soils on alluvial fans, foothills, and lake terraces. The surface layer is silt loam, and the underlying layers are silty clay loam or silt loam. Slopes range from 0 to 6 percent. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 100 to 140 days. These soils are of the Hendricks, Mendon, and Red Rock series.

The rate of water intake is moderate, and permeability is moderately slow to moderate. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 14 to 16 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

The common rotation on these soils is alternate wheat and fallow (fig. 15). Alfalfa is a suited legume but is not extensively used. Moisture and climatic limitations restrict crop growth.

Tillage operations should be limited to those essential for controlling weeds, conserving moisture, and preparing a good seedbed. An effective sequence is spring chisel, followed by sweeps, and then one or two rod weedings prior to seeding. Occasionally, a disc plow may be used for the first operation if excess residue becomes a management concern.

All residue should be protected from fire and overgrazing, and as much residue as possible should be left on or near the surface. This managment of crop residue is effective in reducing erosion, increasing the intake of water into the soil, and reducing evaporation losses.

Crop residue management and contour farming are effective conservation practices that keep runoff to a minimum and allow a maximum of the limited rainfall to enter the soil. Terraces and stripcropping commonly are good supporting measures for keeping available moisture in the field where it falls. Diversions or terraces or both, together with contour farming and crop residue management, also are effective in keeping soil losses within acceptable limits.

CAPABILITY UNIT IIIe-U, NONIRRIGATED

This capability unit consists of well-drained soils on lake terraces, alluvial fans, and mountain foot slopes. The surface layer is silty clay loam, silt loam, loam, or fine sandy loam. The underlying layers are clay, silty clay loam, silt loam, or fine sandy loam. Slopes range from 1 to 10 percent. Average annual precipitation ranges from 13 to 18 inches, and the frost-free period is 100 to 140 days. These soils are of the Anty, Forsgren, Gemson, Kearns, Kidman, Munk, Parleys, Pomat, Red Rock, and Timpanogos series.

The rate of water intake is rapid to slow, and permeability is slow to moderately rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is 7.5 to 12 inches to a depth of 5 feet. The water-supplying capacity is 10 to 16 inches before moisture is depleted. Roots penetrate to a depth of about 60 inches.

The common rotation on these soils is alternate wheat and fallow. Alfalfa is a suited legume but is not extensively used. Moisture and climatic limitations restrict alfalfa production.

Tillage operations should be limited to those essential for controlling weeds, conserving moisture, and preparing a good seedbed. Chisels, sweeps, and rod weeders are effective tillage tools. An effective sequence is spring chisel, followed by sweeps, and then one or two rod weedings prior to seeding. Occasionally, a disc plow may be used for the first operation if excess residue becomes a management concern.

All residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface. The management of crop residue is effective in reducing erosion, increasing the intake of water into the soil, and reducing evaporation losses.

Diversions are installed to intercept and control runoff from higher ground, generally range. Terraces are spaced to limit the distance water can travel downslope before it is intercepted and controlled. Contour farming and residue management supplement the terraces by slowing runoff and allowing more time for water to enter the soil. Terrace spacing is directly related to the field slope and the level of planned residue management. Diversions or terraces or both, together with contour farming and crop residue management, also are effective in keeping soil losses within acceptable limits.

Figure 15.—**Grain stubble on Hendricks silt loam, 1 to 3 percent slopes. This soil is in capability unit IIe–M, nonirrgated.**

CAPABILITY UNIT IIIe-M, NONIRRIGATED

This capability unit consists of well-drained soils on alluvial fans, mountain foot slopes, and lake terraces. The surface layer is silt loam or loam, and the subsoil is silty clay or silty clay loam. Slopes range from 6 to 10 percent. Average annual precipitation ranges from 16 to 21 inches, and the frost-free period is 85 to 140 days. These soils are of the Hendricks, Manila, and Mendon series.

The rate of water intake is moderate, and permeability is slow to moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is 10 to 13 inches to a depth of 5 feet. The water-supplying capacity is 12 to 16 inches before moisture is depleted. Roots penetrate to a depth of about 50 to 60 inches or more.

The common rotation on these soils is alternate wheat and fallow. Alfalfa is a suited legume but is not extensively used. Moisture and climatic limitations restrict crop growth.

Tillage operations should be limited to those essential for controlling weeds, conserving moisture, and preparing a good seedbed. Chisels, sweeps, and rod weeders are effective tillage tools. An effective sequence is spring chisel, followed by sweeps, and then one or two rod weedings prior to seeding. Occasionally, a disc plow may be used for the first operation if excess residue becomes a management concern.

All residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface. This management of crop residue is effective in reducing erosion, increasing the intake of water into the soil, and reducing evaporation losses.

Crop residue management and contour farming are effective conservation practices that keep runoff to a minimum and allow a maximum of the limited rainfall to enter the soil. Terraces and stripcropping commonly are good supporting measures for keeping available moisture in the field where it falls. Diversions or terraces or both, together with contour farming and crop residue management, also are effective in keeping soil losses within acceptable limits.

CAPABILITY UNIT IIIc-U, NONIRRIGATED

This capability unit consists of well-drained soils. The surface layer is silt loam or loam, and the underlying layers are silty clay loam, silt loam, or fine sandy loam. Slopes are 0 to 1 percent. Average annual precipitation ranges from 14 to 17 inches, and frost-free period is 100 to 140 days. These soils are of the Kidman, Parleys, and Red Rock series.

The rate of water intake is moderate to slow, and permeability is moderately slow to moderate. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 7.5 to 12 inches to a depth of 5 feet. The water-supplying capacity is 10 to 14 inches before mositure is depleted. Roots penetrate easily to a depth of 60 inches. The Red Rock soil generally receives runoff from adjacent higher areas.

The common rotation on these soils is alternate wheat and fallow. Alfalfa is a suited legume but is not extensively used. Moisture and climatic limitations restrict crop growth.

Tillage operations should be limited to those essential for controlling weeds, conserving moisture, and preparing a good seedbed. Chisels, sweeps, and rod weeders are effective tillage tools. An effective sequence is spring chisel, followed by sweeps, and then one or two rod weedings prior to seeding. Occasionally, a disc plow may be used for the first operation if excess residue becomes a management concern.

All residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface. The management of crop residue is effective in increasing the intake of water into the soil, reducing evaporation losses, and controlling erosion.

Crop residue management is an effective conservation practice that keeps runoff to a minimum and allows a maximum of the limited rainfall to enter the soil. Stripcropping is commonly a good supporting measure for keeping available moisture in the field where it falls.

CAPABILITY UNIT IVe-U, NONIRRIGATED

This capability unit consists of well-drained soils on mountain foot slopes, alluvial fans, and lake terraces. The surface layer is silty clay loam, silt loam, or loam. The underlying layers are silty clay loam, clay loam, silt loam, or fine sandy loam. Slopes range from 10 to 20 percent. Average annual precipitation ranges from 13 to 18 inches, and the frost-free period is 110 to 130 days. These soils are of the Forsgren, Gemson, Kearns, Kidman, Munk, and Parleys series. Also in this unit is the Kearns high lime variant.

The rate of water intake is moderate to slow, and permeability is slow to moderate. Runoff is rapid, and the hazard of erosion is high. In places, moderate rill erosion is common and shallow gullies have been formed. The available water holding capacity is 7.5 to 12 inches to a depth of 5 feet. The water-supplying capacity is 10 to 14 inches before moisture is depleted. Roots penetrate to a depth of 60 inches. Fine gravel is on the surface and throughout the profile in some areas.

Because these soils are steep, the crop rotation is one of the more important management practices. Wheat, alfalfa, and grass are suitable crops. A suitable rotation is wheat and fallow for 6 to 8 years and alfalfa or a mixture of alfalfa and grass for 6 to 8 years. This rotation should be planned and seeded in alternate contour strips so that approximately half of the field is in permanent cover at all times.

To maintain soil tilth, tillage operations should be limited to those essential for seedbed preparation and weed and moisture control. Implements that leave maximum amounts of residue on or near the surface should be used. Chisels, sweeps, and rod weeders are effective tillage tools.

Because the slopes are steep, terracing generally is not practical on these soils, and contour farming has limited effectiveness in controlling erosion.

CAPABILITY UNIT IVe-UZ, NONIRRIGATED

This capability unit consists of well-drained soils on lake terraces, fans, and offshore bars. The surface layer is silt loam, loam, fine sandy loam, or gravelly loam. The underlying layers are silty clay loam, fine sandy loam, silt loam, loam, or gravelly loamy very fine sand. These soils formed in mixed lake sediments that are high in content of lime. Slopes range from 1 to 10 percent. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. These soils are of the Eccles, Hansel, Kearns, Pomat, Stingal, Thiokol, and Windmill series.

The rate of water intake is moderate to rapid, and permeability is moderately slow to moderately rapid. Runoff is slow to medium, and the hazard of erosion is slight to high. Moderate sheet erosion is common on the Pomat soil. The available water holding capacity is 7.5 to 12 inches to a depth of 5 feet, except in the Windmill soil where it is 5 to 6 inches. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more, but most of them extend to a depth of about 20 to 30 inches.

The common rotation on these soils is alternate wheat and fallow. Alfalfa is a suited legume but is not extensively used. Moisture and climatic limitations restrict crop growth.

To maintain soil tilth, tillage operations should be limited to those essential for controlling weeds, conserving moisture, and preparing a good seedbed. Chisels, sweeps, and rod weeders are effective tillage tools. An effective sequence is spring chisel, followed by sweeps, and then one or two rod weedings prior to seeding.

CAPABILITY UNIT IVe-M, NONIRRIGATED

This capability unit consists of well-drained soils on alluvial fans and foothills. The surface layer is silt loam or

loam, and the underlying layers are silty clay or silty clay loam. Slopes range from 10 to 25 percent. Average annual precipitation ranges from 16 to 21 inches, and the frost-free period is 85 to 130 days. These soils are of the Hendricks and Manila series.

The rate of water intake is moderate, and permeability is slow or moderately slow. Runoff is medium or rapid, and the hazard of erosion is moderate or high. In places, moderate rill erosion is common. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 12 to 16 inches before moisture is depleted. Roots penetrate to a depth of about 50 to 60 inches or more.

The common rotation on these soils is alternate wheat and fallow. Alfalfa is a suited legume that can be grown alone or in a mixture with suitable grasses for hay or pasture. A good rotation includes alfalfa or grass or both.

Tillage operations should be limited to those essential for controlling weeds, conserving moisture, and preparing a seedbed. Chisels, sweeps, and rod weeders are effective tillage tools.

All residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface to help control erosion. Surface residue also helps to increase the intake of water into the soil and to reduce evaporation losses.

These soils are too steep for farmable terrace systems. Contour farming, contour strips that include alternate strips of alfalfa and grass, diversions, minimum tillage, and crop residue management are effective conservation practices that help to keep soil losses within acceptable limits. Diversions are located to intercept and control runoff from higher ground, generally range, and at intervals where other applied practices become ineffective for controlling erosion.

To control erosion and increase the rate of water intake, all residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface. Diversions or terraces or both, together with contour farming (fig. 16) and crop residue management, are effective in keeping soil losses within acceptable limits.

THE CAPABILITY UNIT IVs-U4, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils on alluvial fans and terraces. The surface layer is loam, gravelly loam, or gravelly silt loam, and the underlying layers are very gravelly loam, very gravelly loamy sand, or very cobbly loam. These soils formed in very gravelly or cobbly alluvium. Slopes range from 1 to 20 percent but exceed 10 percent only on the Sterling soil. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 110 to 140 days. These soils are of the Bingham, DeJarnet, and Sterling series.

The rate of water intake is moderate to very rapid, and permeability is moderate to rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is 3.5 to 6.5 inches to a depth of 5 feet. The water-supplying capacity is 8 to 11 inches before moisture is depleted. Roots penetrate to a depth of more than 60 inches, but most roots are in the top 20 to 30 inches of soil. In places, the Bingham soil lacks gravel in the surface layer.

The common rotation on these soils is alternate wheat and fallow. Alfalfa and drought-resistant grasses are used to a limited extent in the rotation. Because the available water holding capacity is limited and the soils are droughty, fertilizers are generally not used.

Tillage operations should be only those essential for weed control, moisture conservation, and seedbed preparation. All residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface. This residue management is effective in reducing erosion and moisture losses through evaporation.

Because of the gravel and cobblestones, these soils tend to be droughty. Therefore, a limited amount of moisture is held available for plant use. Erosion and climatic conditions are secondary concerns.

Diversions or terraces or both, together with contour farming and crop residue management, are effective for conserving water and controlling erosion.

CAPABILITY UNIT IVs-UZ, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils on lake terraces, alluvial fans, and terrace escarpments. The surface layer is silt loam, loamy sand, or gravelly silt loam. The underlying layers are silty clay loam, sandy loam, very gravelly silt loam, or very cobbly loam. Slopes range from 1 to 20 percent. Average annual precipitation ranges from 11 to 14 inches, except on the Sterling soil, where it ranges from 14 to 17 inches. The frost-free period is 100 to 140 days. These soils are of the Hupp, Sanpete, and Sterling series. Also in this unit are the Eccles sandy variant and areas of Parleys silt loam where they are mapped in complex with Sterling soils.

The rate of water intake is moderate to very rapid, and permeability is moderately rapid to rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Moderate sheet and rill erosion are common on the Sanpete soil. The available water holding capacity is 4 to 7 inches to a depth of 5 feet. The water-supplying capacity is 7 to 9 inches before moisture is depleted. Some roots penetrate to a depth of 60 inches, but most roots extend to a depth of about 24 to 30 inches.

The common rotation on these soils is alternate wheat and fallow. Alfalfa and drought-resistant grasses are used to a limited extent in the rotation. Because the available water holding capacity is limited and the soils are droughty, use of fertilizers is not generally economical.

Because these soils are sandy and gravelly, they tend to be droughty. Therefore, only a limited amount of moisture is retained and held available for use by plants. Erosion and climatic conditions are secondary concerns.

To control erosion, all residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface. Diversions or terraces or both, together with contour farming and crop residue management, are effective in conserving moisture and controlling erosion. To maintain soil tilth, tillage operations should be limited to those essential for weed control, moisture conservation, and seedbed preparation.

CAPABILITY UNIT IVc-U, NONIRRIGATED

This capability unit consists of well-drained soils. The surface layer is silt loam or fine sandy loam, and the underlying layers are silty clay loam, silt loam, or fine sandy loam. These soils formed in mixed lake sediments

Figure 16.—**Contour stripcropping on Thiokol and Hansel soils in Blue Creek Valley and Howell Valley. These soils are in capability unit IVe–UZ, nonirrigated.**

that are high in content of lime. Slopes are 0 to 1 percent. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days. These soils are similar to those described in capability unit IVe–UZ, but they are more nearly level. These soils are of the Eccles, Hansel, and Thiokol series.

The rate of water intake is moderate to rapid, and permeability is moderately slow to moderately rapid. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 7.5 to 12 inches to a depth of 5 feet. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more, but most of them extend to a depth of 20 to 32 inches.

The common rotation on these soils is alternate wheat and fallow. Alfalfa is a suited legume but is not extensively used. Moisture and climatic limitations restrict crop growth.

Tillage operations should be limited to those essential for controlling weeds, conserving moisture, and preparing a good seedbed. Chisels, sweeps, and rod weeders are effective tillage tools. An effective sequence is spring chisel, followed by sweeps, and then one or two rod weedings prior to seeding.

All residue should be protected from fire and overgrazing. As much residue as possible should be left on or near the surface. This management of crop residue is effective in increasing the intake of water into the soil, reducing evaporation losses, and reducing erosion.

Climate, particularly low rainfall, is the main limitation of these soils, Minimum tillage, management of residue, and contour farming are effective measures for conserving the limited moisture. Terraces and stripcropping commonly are good supporting practices.

CAPABILITY UNIT VIe-U, NONIRRIGATED

This capability unit consists of well-drained soils on mountain slopes, alluvial fans, terraces, and offshore bars. The surface layer is silt loam, gravelly loam, or cobbly silt loam. The underlying layers are silt loam, gravelly loamy very fine sand, or very cobbly silt loam. Slopes range from 6 to 30 percent. Average annual precipitation ranges from 11 to 18 inches, and the frost-free period is 100 to 140 days. These soils are of the Collinston, Kearns, Middle, Parleys, Pomat, Wheelon, and Windmill series. Also included in this unit are areas of Rock outcrop.

The rate of water intake is rapid, and permeability is moderate to moderately rapid. Runoff is medium to rapid, and the hazard of erosion is slight to high. In places, moderate sheet erosion is common and a few shallow gullies have been formed. The Collinston, Pomat, and Wheelon soils are nongravelly. The gravel in the Windmill soil is mainly less than one-half inch in diameter. The Middle soil is 24 to 38 inches deep over bedrock. The available water holding capacity is 5 to 6 inches for the Windmill soil, 2.5 to 4 inches for the Middle soil, and 9 to 12 inches for the other soils. The water-supplying capacity is about 8 to 12 inches before moisture is depleted. Roots extend mainly to a depth of 12 to 30 inches but may extend to a depth of more than 60 inches in all but the Middle soils. In the Middle soils, roots penetrate to bedrock, which is at a depth of 24 to 38 inches.

The Wheelon and Collinston soils are intermingled. The Wheelon soils are on the knolls and the Collinston soils in the less sloping areas between the knolls. Where these soils are used for nonirrigated crops, conservation measures are needed for the highly erodible Wheelon soils.

The soils in this unit are used mainly for range and wildlife habitat. Some of the less sloping areas are used for nonirrigated small grains. The native vegetation is bluebunch wheatgrass, Sandberg bluegrass, sand dropseed, big sagebrush, bitterbrush, yellowbrush, and some juniper.

Proper grazing use is the main management practice needed if the soils are in good or excellent condition. If the soils are in poor or fair condition, brush control and reseeding may also be needed. Alfalfa seeded in alternate rows with crested wheatgrass or Siberian wheatgrass is suitable.

CAPABILITY UNIT VIe-M, NONIRRIGATED

This capability unit consists of well-drained soils on mountain slopes and fans. The surface layer is clay, clay loam, or heavy loam, and the underlying layers are clay or silty clay. Slopes are 0 to 40 percent but are 0 to 1 percent in the Goring brown subsoil variant. Average annual precipitation ranges from 18 to 26 inches, and tbe frost-free period is 80 to 110 days. These soils are of the Goring and Obray series. Also in this unit is the Goring brown subsoil variant.

The rate of water intake is slow, and permeability is slow to very slow. Runoff is slow to rapid, and the hazard of erosion is slight to high. The available water holding capacity is 11 to 13 inches to a depth of 5 feet. The water-supplying capacity is 14 to 22 inches before moisture is depleted. Roots penetrate to a depth of 60 inches. These soils commonly have cracks, ½ to 1 inch wide, that extend to a depth of 30 to 40 inches.

The soils in this unit are used for range, wildlife habitat, and water supply. These soils have severe limitations because of cold climate and fine textures that make them unsuitable for cultivation. The native vegetation is Great Basin wildrye, bearded wheatgrass, big sagebrush, and native bluegrass.

Proper grazing use is the management practice needed if the soils are in good or excellent condition. If the soils are in fair or poor condition, brush control and reseeding may be needed. Alfalfa and intermediate wheatgrass or pubescent wheatgrass can be seeded in alternate rows.

CAPABILITY UNIT VIe-H, NONIRRIGATED

Lucky Star silt loam, 25 to 40 percent slopes, is the only soil in this capability unit. It is a well-drained soil on north-facing mountain slopes. The subsoil is gravelly clay loam. Average annual precipitation ranges from 22 to 28 inches, and the frost-free period is 70 to 80 days.

The rate of water intake is rapid, and permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. The available water holding capacity is 7 to 9 inches to a depth of 5 feet. The water-supplying capacity is 13 to 19 inches before moisture is depeleted. Aspen roots extend to a depth of more than 60 inches.

This soil is used for range, wildlife habitat for big-game animals, and water supply. The native vegetation is an overstory of aspen and an understory of chokecherry, goldenrod, western coneflower, bearded wheatgrass, and mountain brome.

Proper grazing use is the only management practice needed for this soil. Because the soil is steep and rocky, no mechanical practices are possible.

CAPABILITY UNIT VIs-U, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils. These soils are on alluvial fans, mountain foot slopes, and terrace escarpments. The surface layer is gravelly or cobbly silt loam or gravelly sandy loam. The underlying layers range from very gravelly or very cobbly loam to very gravelly sand or gravelly coarse sand. Slopes range from 6 to 30 percent. Average annual precipitation ranges from 11 to 18 inches, and the frost-free period is 100 to 150 days. These soils are of the Abela, Blue Star, Kilburn, Munk, Sandall, Sanpete, Sheeprock, Sterling, and Wasatch series. The Blue Star gravelly subsoil variant is in this unit also.

The rate of water intake is moderate to very rapid, and permeability is moderate to rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Moderate sheet erosion is common on the Munk and Sanpete soils, and a few shallow gullies have been formed in places. The available water holding capacity is 2 to 7 inches to a depth of 5 feet or to bedrock. The water-supplying capacity is 5 to 9 inches before moisture is depleted. Munk soils are 30 to 40 inches deep to bedrock, and Sandall soils are 22 to 40 inches deep to bedrock. All the other soils are more than 60 inches deep.

The soils in this unit are used mainly for range and wildlife habitat. The less sloping areas are used for nonirrigated small grains. Some of the soils are used as a source of gravel and, to a limited extent, for urban and industrial developments. The native vegetation is big sagebrush, Indian ricegrass, bluebunch wheatgrass, Sandberg bluegrass, yellowbrush, bitter-brush, cheatgrass, and in places, some juniper.

Proper grazing is the only management practice needed if the range is in good or excellent condition. Brush control and seeding may also be needed if the range is in fair or poor condition. Alfalfa can be seeded in alternate rows with Siberian wheatgrass or crested wheatgrass.

CAPABILITY UNIT VIs-M, NONIRRIGATED

This capability unit consists of well-drained soils that are mainly on north- and east-facing mountain slopes. The surface layer is cobbly clay loam or cobbly loam, and the underlying layers are very gravelly clay loam or very cobbly clay. Slopes range from 20 to 30 percent. Average annual precipitation ranges from 16 to 25 inches, and the frost-free period is 75 to 100 days. These soils are of the Broad and Yeates Hollow series.

The rate of water intake is moderate to slow, and permeability is slow to moderate. Runoff is slow or medium, and the hazard of erosion is slight to moderate. The available water holding capacity is 4 to 7 inches. The water-supplying capacity is 6.5 to 11 inches before moisture is depleted. The Broad soil is 30 to 40 inches deep over bedrock, and the Yeates Hollow soil is 40 to more than 60 inches deep over bedrock.

The soils of this unit are used for range, wildlife habitat, and water supply. The native vegetation is mainly bluebunch wheatgrass and some Sandberg bluegrass, yellowbrush, big sagebrush, serviceberry, and annual weeds.

Proper grazing may be the only management practice needed if the range is in good or excellent condition. If it is in poor or fair condition, brush control and seeding may also be needed. Alfalfa can be seeded in alternate rows with intermediate wheatgrass or pubescent wheatgrass.

CAPABILITY UNIT VIIe-S, NONIRRIGATED

This capability unit consists of well-drained soils. The surface layer of these soils is silt loam, and the underlying layers are silt loam, loam, or very fine sandy loam. Slopes range from 0 to 10 percent but most commonly are 0 to 3 percent. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 130 days. These soils are of the Palisade and Thiokol series. The Palisade soils are slightly to strongly affected by salts and alkali, but the effect of salts and alkali in the upper 20 to 30 inches of soil is generally not harmful.

The rate of water intake is moderate in the soils of this unit, and permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The water-holding capacity is 8 to 12 inches to a depth of 5 feet, and this much water is available to plants growing on the Thiokol soil, but the water available to plants is reduced to about 4 to 8 inches in the Palisade soils because of the salt content. The water-supplying capacity is 6 to 8 inches before moisture is depleted.

The soils in this unit are used for range and wildlife habitat. The native vegetation is mainly big sagebrush but includes some yellowbrush, snakeweed, squirreltail, annual mustard, and cheatgrass.

Proper grazing use is always needed. Brush control and range seeding are used in some places where the soils are in fair or poor condition. Russian wildrye, crested wheatgrass, or Siberian wheatgrass is drill seeded on these soils with only marginal success.

CAPABILITY UNIT VIIe-U, NONIRRIGATED

This capability unit consists of well-drained soils. These soils are on lake terraces, dissected terrace escarpments, and mountain slopes. The surface layer is silt loam or cobbly silt loam, and the underlying layers are silt loam or very cobbly silt loam. Slopes range from 30 to 70 percent. Average annual precipitation ranges from 12 to 18 inches, and the frost-free period is 100 to 140 days. These soils are of the Middle, Pomat, and Wheelon series. Also included are areas of Rough broken land and Rock outcrop.

The rate of water intake is moderate to slow, and the permeability is moderate. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. The available water holding capacity for the Middle soil is 2.5 to 4 inches. This soil is underlain by bedrock at a depth of 24 to 38 inches. The available water holding capacity for the other soils is 9 to 12 inches to a depth of 5 feet. The water-supplying capacity is 8 to 12 inches before moisture is depleted. Roots penetrate mainly to a depth of 20 to 30 inches. The Pomat and Wheelon soils are nongravelly, light colored, and strongly calcareous. Sheet and rill erosion are active, and many shallow gullies have been formed on these soils. On Rough broken land, soil slipping is common and the steep slopes have a succession of short, vertical exposures.

These soils are used mainly for range and wildlife habitat, but some of the less sloping areas are used for nonirrigated crops. Rough broken land has little or no value for farming and is used mainly for wildlife habitat. The native vegetation is bluebunch wheatgrass, Indian ricegrass, Sandberg bluegrass, big sagebrush, bitterbrush, Russian thistle, and cheatgrass. Trees and shrubs and some grasses are on Rough broken land.

Proper grazing use may be the only practice needed on the soils in this unit if the range is in good or excellent condition.

CAPABILITY UNIT VIIe-M, NONIRRIGATED

This capability unit consists of well-drained soils on mountain slopes and alluvial fans. The surface layer is silt loam, loam, or gravelly loam. The underlying layers are clay, cobbly clay, gravelly clay loam, or very gravelly loam. Slopes range from 20 to 70 percent but most commonly are 40 to 60 percent. Average annual precipitation ranges from 17 to 26 inches, and the frost-free period is 70 to 100 days. These soils are of the Elzinga, Maughan, Manila, Picayune, and Smarts series.

The rate of water intake is slow to rapid, and permeability is slow to moderate. Runoff is medium or rapid, and the hazard of erosion is moderate or high. The available water holding capacity is 6 to 12 inches to a depth of 5 feet. The water-supplying capacity is 12 to 21 inches before moisture is depleted. Roots extend to a depth of 24 inches. During periods of rapid rainfall, runoff carries a large amount of silt from the Picayune soils if they are not protected.

Soils in this unit are used for range, wildlife habitat, and water supply. The native vegetation consists of blue-

bunch wheatgrass, slender wheatgrass, tall native bluegrass, Great Basin wildrye, snowberry, serviceberry, big sagebrush, and in some areas, bitterbrush, maple, and oregongrape.

Proper grazing is the only management practice needed for these soils.

CAPABILITY UNIT VIIe-HC, NONIRRIGATED

Bickmore loam, 50 to 70 percent slopes, is the only soil in this capability unit. It is a well-drained soil on north-facing mountain slopes. The subsoil is gravelly silty clay loam, and the underlying layer is very gravelly loam that is underlain by limestone bedrock at a depth of 36 to 40 inches. Average annual precipitation ranges from 24 to 28 inches, and the frost-free period is 45 to 60 days.

The rate of water intake is rapid, and permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. The available water holding capacity is 4 to 6 inches to bedrock. The water-supplying capacity is 11 to 13 inches before moisture is depleted. Roots extend to bedrock.

The soil in this unit is used mainly for woodland, but it is also used for water supply and wildlife habitat. Moderate production of Douglas-fir can be expected. Sawtimber is harvested from some areas. Equipment limitations are moderate because of the steepness of the slopes. The native vegetation is mainly Douglas-fir and alpine fir. However, in openings there is an understory of snowberry, oregongrape, horsemint, and lupine. Plant competition will delay, but not prevent, development of a fully stocked stand of woodland trees.

Proper woodland management and use is the only management practice needed for this soil.

CAPABILITY UNIT VIIw-2, NONIRRIGATED

Peteetneet peat, moderately deep variant, is the only soil in this capability unit. It is a very poorly drained soil on lake plains and in depressions of low terraces. The underlying layer is fibrous peat and muck in the upper part and is silty clay in the lower part. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 130 to 145 days.

The rate of water intake is moderate. Permeability is moderate to a depth of 24 inches and is slow between that depth and a depth of more than 60 inches. Runoff is very slow, and the hazard of erosion is none. The available water holding capacity is 11 to 13 inches to a depth of 5 feet. Roots are concentrated in the upper 18 to 30 inches of soil. The water table is at or near the surface most of the time.

The acreage of this soil is very small and is entirely in an area southwest of Tremonton. The soil is used mainly to provide wildlife habitat for migratory waterfowl. In places the overflow water has been diverted from these wet areas, and these areas are used for improved range consisting mostly of tall wheatgrass. The native vegetation is sedges, tules, rushes, wiregrass, and common cattails.

The main management practice needed for this soil is to divert the surface water and to introduce plants that will improve the forage production, as practically all of the acreage is used exclusively for grazing or wildlife habitat. The introduction of reed canarygrass and other desirable water-tolerant grasses has been effective in making such improvements.

CAPABILITY UNIT VIIw-28, NONIRRIGATED

This capability unit consists of poorly drained and somewhat poorly drained soils. These soils are on flood plains, low lake terraces, and lake plains. The surface layer is silty clay loam, silt loam, or fine sandy loam. The underlying layer ranges from clay to fine sandy loam but, in many of the soils, is stratified. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Average annual precipitation ranges from 11 to 16 inches, and the frost-free period is 100 to 150 days. These soils are of the Airport, Arave, Gooch, Lakeshore, Lasil, Logan, Payson, Placeritos, Refuge, Saltair, and Woods Cross series.

The soils in this unit are moderately to very strongly affected by salts and alkali. The rate of water intake is slow to moderate, and permeability is very slow to moderate. Runoff is very slow to slow, and the hazard of erosion is none to slight. Because of the high salt content, the water available to plants is only about 3 to 9 inches. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to a depth of 5 feet, except in the Placeritos and Refuge soils, where it is 8 to 11 inches. Most roots are in the upper 18 to 24 inches of soil. Where the soils are not drained, depth to the water table generally ranges from 20 to 40 inches, but in places the water table is at or near the surface most of the year. The Placeritos soils are subject to flooding and overflow, and they have a water table near the surface in spring.

The soils in this unit are used mainly for range and as habitat for migratory waterfowl. Some areas are used for improved pasture consisting mostly of tall wheatgrass, and limited areas are used for irrigated small grains and alfalfa. The Lakeshore, Logan, and Woods Cross soils are used mainly for meadow pasture that is grazed. The native vegetation is mainly saltgrass and includes some alkali sacaton, greasewood, annual mustard, foxtail, and annual weeds. Some areas are nearly barren or have a sparse cover of pickleweed and saltgrass.

The main limitations of these soils are the moderate to severe effect of salt and alkali, the high water table, the lack of effective outlets for drains, and the overflow and flooding of certain areas. The main management practices needed are the introduction of improved forage plants that will tolerate existing conditions, the improved distribution of any available surface water, and proper grazing use.

CAPABILITY UNIT VIIs-D8, NONIRRIGATED

This capability unit consists of well drained and moderately well drained soils. These soils are on lake plains and low lake terraces in the adjoining area north and west of Locomotive Springs National Wildlife Refuge. The surface layer is silt loam. The underlying layers are silty clay or silty clay loam that shows some stratification. Slopes range from 0 to 6 percent but most commonly are 0 to 2 percent. Average annual precipitation ranges from 6 to 8 inches, and the frost-free period is 100 to 120 days. These soils are are of the Drum and Uffens series.

The soils in this unit are slightly to strongly affected by salts and moderately to strongly affected by alkali. The rate of water intake is slow to moderate, and permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. In places, shallow gullies have been formed. Because of the salt contained

in these soils, the water available to plants is only about 3 to 7 inches. The water-supplying capacity is about 4 to 6 inches before moisture is depleted. If the soils are reclaimed, the available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots can extend to a depth of 60 inches or more, but most roots are in the top 18 inches of soil.

The soils in this unit are used for range. The native vegetation is greasewood, shadscale, pickleweed, rubber rabbitbrush, kochia, annual mustard, cheatgrass, and some big sagebrush.

Proper grazing use will help to maintain the more desirable vegetation of these soils.

CAPABILITY UNIT VIIs-S, NONIRRIGATED

This capability unit consists of somewhat excessively drained to moderately well drained soils. These soils are on lake terraces, terrace escarpments, and mountain foot slopes. The surface layer is loamy sand, gravelly silt loam, or extremely stony silt loam, and the underlying layers are sand, very gravelly silt loam, or very cobbly silt loam. In places the surface is covered with basalt stones ranging from 1 to 5 feet across. Slopes range from 1 to 30 percent. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 150 days. These soils are of the Etil, Sanpete, Saxby, and Thiokol series. Also in this unit is Very stony land.

The rate of water intake is slow to very rapid, and permeability is moderate to rapid. Runoff is very slow to medium, and the hazard of erosion is slight to moderate. The Etil soils are subject to soil blowing. The available water holding capacity is 2 to 5 inches above bedrock or to a depth of 5 feet. The water-supplying capacity is 3 to 9 inches before moisture is depleted. The Saxby soils are 17 to 20 inches deep to bedrock.

The soils in this unit are used for range and wildlife habitat. The native vegetation is big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, yellowbrush, squirreltail, and cheatgrass.

Proper grazing use is the only management practice needed for these soils.

CAPABILITY UNIT VIIs-S8, NONIRRIGATED

This capability unit consists of well drained and moderately well drained soils. These soils are chiefly on low lake terraces, but the Pogal soils are on wind-deposited mounds on lake plains. The surface layer is mainly silt loam, and the underlying layers are silty clay, silty clay loam, or silt loam. Slopes range from 0 to 6 percent but most commonly are less than 1 percent. Average annual precipitation ranges from 8 to 14 inches, and the frost-free period is 100 to 130 days. These soils are of the Bram, Harding, Mellor, Pogal, and Thiokol series.

The soils in this unit are moderately to strongly affected by salts and alkali. The rate of water intake is slow to moderate, and permeability is slow to moderate. Runoff is medium, and the hazard of erosion is moderate. In places, shallow gullies have been formed and sheet erosion is active. Because of the high salt content, the water available to plants is only 3 to 7 inches. The water-supplying capacity is 5.5 to 8 inches before moisture is depleted, except in the Pogal soils, where it is 8.5 to 10.5 inches. If the soils of this unit are reclaimed, the available water holding capacity is 9 to 12 inches to a depth of 5 feet. Roots are concentrated in the upper 18 to 30 inches of soil, but in the Pogal soils they extend easily to a depth of 60 inches. Soil blowing is a common hazard on the Pogal soils, and these soils commonly have windblown hummocks.

The soils in this unit are used mainly for range and wildlife habitat. The Pogal soils are used mainly to provide wildlife habitat for migratory waterfowl. The native vegetation is shadscale, greasewood, fourwing saltbush, winterfat, squirreltail, kochia, annual mustard, and cheatgrass.

Proper grazing use will help to maintain the more desirable vegetation on these soils.

CAPABILITY UNIT VIIs-U, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils. These soil are on alluvial fans, lake terraces, mountain slopes, and terrace escarpments. The surface layer ranges from gravelly, cobbly, or very cobbly silt loam to sandy loam. Some of these soils are stony. The underlying layers range from gravelly, very gravelly, or very cobbly clay loam to sand. Slopes range from 3 to 70 percent. Average annual precipitation ranges from 11 to 18 inches, and the frost-free period is 100 to 160 days. These soils are of the Abela, Blue Star, Kapod, Kilburn, Middle, Pass Canyon, Promo, Richmond, Ridd, Rozlee, Sandall, Sanpete, Sheeprock, Snowville, and Sterling series. Also in this unit are the Wasatch gravelly subsoil variant, the Wheelon shallow variant, and Stony alluvial land.

The rate of water intake is slow to very rapid, and permeability is moderate to rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. In places, sheet erosion is active and shallow to deep gullies have been formed. The available water holding capacity is 1.5 to 6 inches to a depth of 5 feet or to bedrock. The water-supplying capacity is 4 to 9 inches before moisture is depleted.

The soils in this unit are used mainly for range and wildlife habitat. Some areas are used for industrial and urban development. In places the soils are used as a source of gravel. The native vegetation is chiefly bluebunch wheatgrass, sand dropseed, western wheatgrass, three-awn, big sagebrush, snakeweed, cheatgrass, and, in places, some oakbrush and maple. Juniper is the main vegetation on Promo, Rozlee, and Sandall soils.

Where these soils are used for range, proper grazing use is the only management practice needed. Where juniper is the main vegetation, chaining, controlled burning, or otherwise removing the juniper and seeding to crested wheatgrass or Siberian wheatgrass may be needed.

CAPABILITY UNIT VIIs-M, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils on mountain slopes. The surface layer is gravelly loam, cobbly loam, cobbly clay loam, or very stony loam. The underlying layers are very gravelly loam, very gravelly clay loam, very cobbly clay, or very cobbly loam. Slopes range from 30 to 70 percent. Average annual precipitation ranges from 16 to 26 inches, and the frost-free period is 60 to 100 days. These soils are of the Agassiz, Broad, Foxol, and Yeates Hollow series. Also included in this unit are areas of Rock outcrop.

The rate of water intake is slow to moderate, and permeability is slow to moderate. Runoff is slow to rapid,

and the hazard of erosion is slight to high. The available water holding capacity is 2 to 7 inches. The water-supplying capacity is 5 to 11 inches before moisture is depleted. Depth to bedrock ranges from 14 to 20 inches for the Agassiz and Foxol soils and from 20 to 40 inches for the Broad soils. Roots penetrate to a depth of 40 to 60 inches in the Yeates Hollow soils and to bedrock in the rest of the soils.

The soils in this unit are used for range, wildlife habitat, and water supply. The native vegetation is mainly bluebunch wheatgrass and some bearded wheatgrass, Sandberg wheatgrass, big sagebrush, Great Basin wildrye, balsamroot, serviceberry, and annuals.

Proper grazing use may be the only management practice applicable if the range is in good or excellent condition.

CAPABILITY UNIT VIIc-S, NONIRRIGATED

Thiokol silt loam, low rainfall, 0 to 1 percent slopes, is the only soil in this capability unit. It is well drained and is on lake terraces. The underlying layer is silt loam. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 100 days.

The rate of water intake is moderate, and permeability is moderate. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 6 to 8 inches before moisture is depleted. Roots extend to a depth of 60 inches but mainly to a depth of 30 to 40 inches.

This soil is used chiefly for range and wildlife habitat. A small area southwest of Snowville is used for irrigated small grains, irrigated pasture, alfalfa, and alfalfa seed. The native vegetation is mainly big sagebrush but includes some squirreltail, annual mustard, yellowbrush, Russian-thistle, and cheatgrass.

Proper grazing use will help to maintain the more desirable vegetation on these soils. Range seeding to Russian wildrye, crested wheatgrass, or Siberian wheatgrass may be needed.

CAPABILITY UNIT VIIIe-E, NONIRRIGATED

In this capability unit is Gullied land, a miscellaneous land type that occurs on lake terraces and foothills in the southwestern part of the survey area. Gullied land is marked by a network of many gullies 1 to 10 feet deep, and it takes in large areas where the original surface layer of the soils has been completely removed. The present soil materials are silt loam to fine sandy loam on the lake terraces and are mainly loamy sand in the foothills. In places there are blowouts and sand dunes.

The plant cover is dominantly juniper in the foothills, as well as some big sagebrush, spiny hopsage, Indian ricegrass, and snakeweed. On the lake terraces, the principal plants are greasewood, shadscale, big sagebrush, alkali sacaton, and squirreltail.

Gullied land has little or no value for farming. Runoff is very rapid, and sheet and gully erosion is very active. The main uses of this land type are for wildlife habitat and water supply.

CAPABILITY UNIT VIIIw-2, NONIRRIGATED

In this capability unit is Fresh water marsh, a land type that occurs in natural depressions and manmade, ponded areas. These areas are covered by fresh water most of the year, and when they are not covered, they have a water table within 12 inches of the surface. The soil material ranges from silty clay loam to fine sandy loam, and the underlying layers commonly are highly stratified. In places there are layers of peat as much as 12 inches thick on the surface. The vegetation is limited to common cattails, sedges, and bulrushes.

Fresh water marsh is better suited for wildlife habitat than for most other uses. Many areas are managed for use by migratory waterfowl and the trapping of muskrats. Some areas are used as range by cattle in winter.

CAPABILITY UNIT VIIIw-8, NONIRRIGATED

This capability unit consists of Playas and poorly drained to very poorly drained soils of the Saltair series. These soils are on lake plains that border the Great Salt Lake and inland basins. They are covered by water during part of the year and are very strongly affected by salts and alkali. The surface layer and underlying layers are mainly silty clay loam but range to loam. The surface is smooth, crusted with salt, and patterned by cracks when dry.

These soils have little or no value for farming. They are barren of vegetation, except in scattered areas where saltgrass and pickleweed grow. Some areas have been diked and ponded, and these provide habitat for migratory waterfowl. In places, water spreading has been used to increase the growth of saltgrass.

CAPABILITY UNIT VIIIs-4, NONIRRIGATED

In this capability unit are Borrow pits and Gravel pits. These are pits from which gravel, sand, cobblestones, or other soil material has been removed. The materials taken from the pits have been used in the construction of dams, levees, dikes, roads, railroad grades, and highways.

Borrow pits and Gravel pits have little or no value for crop production and are not suited to use as range. They have some value as wildlife habitat or for industrial use. Some Gravel pits are used as a commercial source of high-quality gravel and sand for concrete.

CAPABILITY UNIT VIIIs-X, NONIRRIGATED

In this capability unit are Rock land and Rock outcrop. These land types are extensive but occupy comparatively small areas on very steep mountains, foothills, cliffs, and ledges. Here, the land consists mainly of bare bedrock but partly of rock rubble, stones, and boulders. In places there is very shallow soil material. Some small depressions, crevices, and cracks have collected enough soil material to support a sparse stand of trees, shrubs, and grass.

Rock land and Rock outcrop have little value as range but are useful as wildlife habitat. In some places they are used to provide fill material for roads and embankments.

Estimated yields

Table 2 gives the estimated acre yields of the main crops and pasture grown on irrigated soils and the yields for nonirrigated wheat. These yields are based on the yield information obtained from farmers for a specific soil. On the most extensive soils, about 20 observations were made for each crop. If no yield information was available for a particular soil, then estimates were made on the basis of yields on a similar soil.

The yields in this table are those expected over a period of years under a moderately high level of management. Absence of yield estimates indicates the crop is not generally grown on the soil. Range and miscellaneous land types are not listed for the crops grown. The yields for wet, salt- and alkali-affected soils are for these soils after adequate drainage and reclamation practices have been applied. The yields given in this table are based on the crop varieties now grown in the survey area.

Use and Management of the Soils for Range [4]

Range is an important resource in Box Elder County, Eastern Part. Approximately 70 percent of the acreage, or about 85,000 acres, is in native vegetation. Perennial grasses, shrubs, and forbs are the main kinds of plants.

The soils that are used for range generally are not suited to cultivation, because of soil characteristics, site factors, or climatic limitations. Some of the soils are very gravelly or very cobbly or stony, and the areas are interspersed with areas of Rock outcrop. Many of the soils are very steep; some soils are wet or are affected by salts or alkali, and these limitations cannot be economically corrected. Some soils lack adequate moisture for cultivated crops, and irrigation water is not available. Some soils are at high elevations where the climate is too cold or the growing season is too short for cultivated crops. Soils used for range are shallow to deep and have a texture ranging from clay to sand. Some soils are uniform throughout their depth; others have been excessively leached and have formed distinct horizons.

Range is used primarily by sheep and cattle in spring, summer, and fall. In the semidesert areas, range is used extensively by sheep and cattle in winter.

Range sites and range condition

There are many differences in the soils and climate of Box Elder County, Eastern Part. For these reasons, there are several different kinds of range. These different kinds of range are called range sites.

Over the centuries, a mixture of plants best adapted for growing on each range site has developed. This group of plants is called the potential or climax plant community for the site. The climax plant community for a site varies slightly from year to year, but the kinds and amounts of plants remain about the same if undisturbed.

The original mixture of plants fitted the soil and climate of the range site so perfectly that other kinds of plants could not move in unless an area was disturbed. So consistent is the relationship among plants, climate, and soils that the climax plant community can be accurately predicted even on severely disturbed sites if the soil is identified.

Range conservationists and soil scientists, working together, group soils that naturally grow the same climax plant communities into range sites.

Repeated overuse by grazing animals, excessive burning, or plowing results in changes in the kinds, proportions, or amounts of climax plants in the plant community. Depending on the kind and degree of disturbance, some kinds of plants increase while others decrease. If disturbance is severe, plants that do not belong in the climax plant community may invade. Plant response to grazing use depends on the kind of grazing animal, the season of use, and how closely the plant is grazed. If good management follows disturbances, however, the climax plant community is gradually reestablished unless the soils have been seriously eroded.

Range condition is an expression of how the present plant community compares with the climax plant community for the range site. The more nearly the present kinds and amounts of plants are like those in the climax plant mixture, the higher the range condition.

The present range condition provides an index to changes that have taken place in the plant community. More important, however, range condition is a basis for predicting the kind and amount of change in the present plant community that can be expected from management and treatment measures. Thus, the rating of range condition indicates the nature of the present plant community, and the climax cover for the range sites represents a goal toward which management may be directed.

Knowledge of the climax plant communities of range sites and the nature of present plant communities in relation to that potential is important in planning and applying conservation on rangeland. Such information is the basis for selecting management objectives, design of grazing systems, managing for wildlife, determining potential for recreation, and for rating watershed conditions.

Any management objective on rangeland must provide for a plant cover that will adequately protect or improve the soil and water resources and meet the needs of the operator. This generally involves increasing the desirable plants and restoring the plant community to near climax conditions. In places, however, a plant cover that is somewhat below climax will better fit specific grazing needs, provide better wildlife habitat, or furnish other benefits and still protect soil and water resources.

Climatic zones and their effect on range

Plants growing on the range in different parts of the survey area are affected by differences in the kind of soil and by differences in climate. Six distinct climatic zones are recognized in the survey area. These zones are determined on the basis of differences in the amount of moisture received and on differences in the average annual temperature and the length of the growing season.

The six climatic zones are the Desert climatic zone, the Semidesert climatic zone, the Upland climatic zone, the Mountain climatic zone, the High Mountain climatic zone, and the Wet and Semiwet climatic zone.

DESERT CLIMATIC ZONE.—The average annual precipitation ranges from 6 to 8 inches. The driest period is in the summer. The growing season is from about April 1 to about June 1, or until moisture is depleted or plants mature. The frost-free period is 100 to 120 days. The mean annual temperature is about 45° to 50° F.

The range site in the Desert climatic zone is Desert Flats.

SEMIDESERT CLIMATIC ZONE.—The average annual precipitation ranges from 8 to 12 inches and occurs mainly in the fall and winter. The precipitation in summer contributes little to the growth of plants. The growing season is from about April 1 to June 15, or until moisture is depleted or plants mature. The frost-free period is about

[4] BENJAMIN B. HEYWOOD, range conservationist, Soil Conservation Service, assisted in preparing this section.

TABLE 2.—*Estimated average acre yields of principal crops and*

[Absence of entry indicates that crop is not suited

Soil	Irrigated [1]			
	Alfalfa	Barley	Corn (silage)	Sugar beets
	Tons	*Bu*	*Tons*	*Tons*
Airport silt loam	3.5	65	18	16
Airport silt loam, sandy substratum	4.5	75	19	20
Anty fine sandy loam, 1 to 6 percent slopes				
Anty fine sandy loam, 6 to 10 percent slopes				
Bingham loam, 1 to 6 percent slopes				
Bingham gravelly loam, 1 to 6 percent slopes				
Bingham gravelly loam, 6 to 10 percent slopes				
Bram silt loam	4.5	75	19	20
Collett silty clay loam	5.0	80	22	20
Collinston-Wheelon silt loams, 6 to 10 percent slopes				
Cudahy silt loam	4.0	60	18	18
Dagor loam, 3 to 6 percent slopes [5]	5.5	85		
DeJarnet gravelly silt loam, 1 to 6 percent slopes				
DeJarnet gravelly silt loam, 6 to 10 percent slopes				
Draper loam, 0 to 3 percent slopes	5.0	80	22	21
Eccles fine sandy loam, 0 to 1 percent slopes				
Eccles fine sandy loam, 1 to 6 percent slopes				
Eccles fine sandy loam, 6 to 10 percent slopes				
Eccles loamy sand, sandy variant, 1 to 6 percent slopes				
Fielding silt loam	5.5	95	24	24
Fielding silt loam, warm	6.0	95	25	25
Forsgren silt loam, 1 to 6 percent slopes				
Forsgren silt loam, 6 to 10 percent slopes				
Forsgren silt loam, 10 to 20 percent slopes				
Francis loamy fine sand, 3 to 6 percent slopes [5]	4.0	70	18	
Fridlo silt loam	4.0	65	17	18
Fridlo silt loam, moderately alkali	5.0	80	20	21
Gemson silty clay loam, 6 to 10 percent slopes				
Gemson silty clay loam, 10 to 20 percent slopes				
Greenson silt loam, clay substratum	5.0	80	23	21
Greenson silt loam, strongly alkali	3.5	65	17	16
Hansel silt loam, 0 to 1 percent slopes	5.5	95	24	23
Hansel silt loam, 1 to 6 percent slopes				
Hansel silt loam, 6 to 10 percent slopes				
Hendricks silt loam, 1 to 6 percent slopes				
Hendricks silt loam, 6 to 10 percent slopes				
Hendricks silt loam, 10 to 20 percent slopes				
Honeyville silty clay loam	5.0	80	22	20
Hupp gravelly silt loam, 1 to 6 percent slopes				
Hupp gravelly silt loam, 6 to 10 percent slopes				
Hupp silt loam, 3 to 6 percent slopes				
Hupp silt loam, 6 to 10 percent slopes				
James Canyon loam, 0 to 3 percent slopes	5.0	80	22	22
Kearns silt loam, 1 to 3 percent slopes	5.5	95	24	23
Kearns silt loam, 3 to 6 percent slopes	5.0	85		
Kearns silt loam, 6 to 10 percent slopes				
Kearns silt loam, 10 to 20 percent slopes				
Kearns silt loam, high lime variant, 10 to 20 percent slopes				
Kidman fine sandy loam, 0 to 2 percent slopes [5]	6.0	95	25	25
Kidman fine sandy loam, 2 to 4 percent slopes [5]	5.5	90	22	22
Kidman loam, 0 to 1 percent slopes				
Kidman loam, 1 to 6 percent slopes				
Kidman loam, 6 to 10 percent slopes				
Kidman loam, 10 to 20 percent slopes				
Kilburn gravelly loam, 1 to 3 percent slopes [5]	4.0	70	18	
Kilburn gravelly sandy loam, 3 to 6 percent slopes [5]	4.0	70		
Kilburn gravelly sandy loam, 6 to 10 percent slopes [5]	3.5	50		
Kirkham silt loam	4.0	60		
Lasil silt loam, moderately alkali	4.5	65	19	18
Lewiston fine sandy loam	5.0	85	23	22
Logan silty clay loam	4.5	75	20	18
Magna silty clay loam	4.0	55	16	17
Manila loam, 6 to 10 percent slopes				
Manila loam, 10 to 25 percent slopes				
Martini fine sandy loam	5.0	80	21	21
Mendon silt loam, 1 to 6 percent slopes				
Mendon silt loam, 6 to 10 percent slopes				

See footnotes at end of table.

pasture grown on irrigated and nonirrigated soils

to the soil or is not commonly grown on it]

Irrigated [1]—Continued								Nonirrigated
Tomatoes	Wheat [2] (spring)	Pasture	Apples	Apricots	Cherries (sour)	Cherries (sweet)	Peaches	Wheat [3] (winter)
Tons	*Bu*	*Cow-acre-days* [4]	*Bu*	*Bu*	*Tons*	*Tons*	*Bu*	*Bu*
	55	200						
18	60	250						
								22
								22
								20
								19
								18
18	65	250						
	75	325						
								18
	55	275						
	80	300	450	325	8.0	7.0	300	
								21
								20
20	80	325						
								20
								20
								16
								15
	85	325						
25	85	350						
								27
								27
								22
15	60	250	450	325	8.0	7.0	300	
	55	225						
19	70	275						
								27
								22
20	75	325						
	50	200						
	85	325						20
								20
								18
								27
								27
								22
18	75	325						
								20
								20
								20
								18
21	80	325						
	85							24
	80	300						24
								20
								18
								18
23	85	350	450	325	8.5	7.5	300	
22	80	325	450	300	8.0	7.0	275	
								30
								23
								21
								18
16	60	275	400	325	8.5	7.5	300	
15	60	250	375	300	8.0	7.0	275	
	40		350	275	7.5	6.5	250	
	50	250						
15	60	225						
21	80	325						
	70	300						
	50	200						
								26
								21
	75	300						
								27
								25

TABLE 2.—*Estimated average acre yields of principal crops and*

Soil	Irrigated [1]			
	Alfalfa	Barley	Corn (silage)	Sugar beets
	Tons	*Bu*	*Tons*	*Tons*
Millville silt loam, 0 to 2 percent slopes	6.0	95	24	23
Millville silt loam, 2 to 4 percent slopes	5.5	90	21	22
Millville silt loam, moderately deep water table, 2 to 4 percent slopes	5.0	85	22	21
Munk gravelly silt loam, 10 to 20 percent slopes				
Palisade silt loam, 1 to 6 percent slopes	4.0	70		
Parleys loam, 0 to 3 percent slopes [5]	6.0	95	25	25
Parleys loam, cool, 0 to 3 percent slopes	5.5	95	24	23
Parleys silt loam, 0 to 1 percent slopes				
Parleys silt loam, 1 to 6 percent slopes				
Parleys silt loam, 6 to 10 percent slopes				
Parleys silt loam, 10 to 20 percent slopes				
Parleys silty clay loam, 0 to 3 percent slopes	5.5	90	24	24
Pomat silt loam, 6 to 10 percent slopes				
Pomat silt loam, 10 to 30 percent slopes				
Red Rock silt loam, high rainfall, 0 to 3 percent slopes				
Red Rock silt loam, 0 to 1 percent slopes	5.0	90	22	21
Red Rock silt loam, 1 to 6 percent slopes				
Roshe Springs silt loam	4.5	75	22	20
Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes				
Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes				
Sterling gravelly loam, 1 to 6 percent slopes				
Sterling gravelly loam, 6 to 20 percent slopes				
Stingal loam, 1 to 6 percent slopes				
Stingal loam, 6 to 10 percent slopes				
Stokes silt loam	4.5	65	19	19
Sunset silt loam	5.0	80	22	21
Syracuse fine sandy loam	5.0	75	22	20
Thiokol silt loam, 0 to 1 percent slopes				
Thiokol silt loam, 1 to 6 percent slopes				
Thiokol silt loam, 6 to 10 percent slopes				
Thiokol silt loam, low rainfall, 0 to 1 percent slopes	4.0	70		
Thiokol silt loam, low rainfall, 1 to 3 percent slopes	4.0	70		
Timpanogos loam, 0 to 3 percent slopes [5]	6.0	95	25	25
Timpanogos loam, 3 to 6 percent slopes [5]	5.5	90		
Timpanogos loam, cool, 0 to 3 percent slopes	5.5	95	24	24
Timpanogos silt loam, 1 to 6 percent slopes				
Timpanogos silt loam, 6 to 10 percent slopes				
Warm Springs fine sandy loam	5.0	85	23	22
Wasatch gravelly sandy loam, 3 to 10 percent slopes [5]	3.5	50		
Windmill gravelly loam, 1 to 6 percent slopes				
Windmill gravelly loam, 6 to 10 percent slopes				
Woods Cross silty clay loam	4.5	75	22	18

[1] About 500 to 700 acres of bush beans or snap beans were grown in Bear River valley in 1970. A stringless variety of bush beans is planted in rows on loam or fine sandy loam soils and reaches a height of 12 to 18 inches. These beans require heavy applications of nitrogen. They yield about 3 to 5 tons per acre. By use of herbicides, they are kept virtually free of weeds at harvesttime and are harvested with mechanical harvesters. In some years, bush beans are double cropped. Peas are seeded about April 1 and harvested, then bush beans are seeded early in July and mature in about 60 to 70 days. Double cropping yields about 2 tons of peas per acre and 3 to 5 tons of bush beans.

[2] Gaines wheat, a new variety of irrigated fall wheat, yields about 20 to 25 percent more than the yields shown for spring wheat. This irrigated wheat is soft and used mainly for feed.

120 days. The mean annual temperature is about 45° to 50° F.

Five range sites are in the Semidesert climatic zone. These are Semidesert Alkali Flats, Semidesert Loam, Semidesert Sand, Semidesert Shallow Loam, and Semisesert Stony Loam.

UPLAND CLIMATIC ZONE.—The average annual precipitation ranges from 12 to 16 inches and occurs mostly as snow in the winter. Precipitation in summer contributes little to the growth of plants. The growing season is from about April 1 to July 1, or until moisture is depleted or plants mature. Some plants show growth late in summer and early in fall if moisture is available. The frost-free period is about 140 days. The mean annual temperature is 45° to 50° F. Elevations range from about 4,500 to 7,500 feet.

There are five range sites in the Upland climatic zone. These are Upland Loam, Upland Sand, Upland Shallow Loam, Upland Stony Hills (Juniper), and Upland Stony Loam.

MOUNTAIN CLIMATIC ZONE.—The average annual precipitation ranges from 16 to 22 inches and occurs mostly as snow in winter. Precipitation in summer contributes little to the growth of plants. The growing season is from about April 15 to about July 31, or until moisture is depleted or plants mature. When moisture is available, some plants show growth late in summer or early in fall. Mountain range sites occur on all exposures and slopes.

pasture grown on irrigated and nonirrigated soils—Continued

Irrigated [1]—Continued								Nonirrigated
Tomatoes	Wheat [2] (spring)	Pasture	Apples	Apricots	Cherries (sour)	Cherries (sweet)	Peaches	Wheat [3] (winter)
Tons	*Bu*	*Cow-acre-days* [4]	*Bu*	*Bu*	*Tons*	*Tons*	*Bu*	*Bu*
23	85	350	----	----	----	----	----	----
22	80	325	----	----	----	----	----	----
19	80	325	----	----	----	----	----	----
----	----	----	----	----	----	----	----	16
----	50	225	----	----	----	----	----	----
24	85	350	450	325	8. 0	7. 0	300	----
----	85	325	----	----	----	----	----	----
----	----	----	----	----	----	----	----	30
----	----	----	----	----	----	----	----	27
----	----	----	----	----	----	----	----	27
----	----	----	----	----	----	----	----	22
----	85	350	----	----	----	----	----	----
----	----	----	----	----	----	----	----	16
----	----	----	----	----	----	----	----	16
----	----	----	----	----	----	----	----	30
----	85	----	----	----	----	----	----	30
----	----	----	----	----	----	----	----	27
----	65	300	----	----	----	----	----	----
----	----	----	----	----	----	----	----	20
----	----	----	----	----	----	----	----	20
----	----	----	----	----	----	----	----	20
----	----	----	----	----	----	----	----	18
----	----	----	----	----	----	----	----	20
----	----	----	----	----	----	----	----	20
----	60	225	----	----	----	----	----	19
----	75	300	----	----	----	----	----	----
----	65	275	----	----	----	----	----	----
----	----	----	----	----	----	----	----	20
----	----	----	----	----	----	----	----	20
----	----	----	----	----	----	----	----	16
----	50	225	----	----	----	----	----	----
----	50	225	----	----	----	----	----	----
25	85	350	450	325	8. 0	7. 0	300	----
----	80	325	450	300	7. 5	6. 5	275	----
----	85	325	----	----	----	----	----	----
----	----	----	----	----	----	----	----	23
----	----	----	----	----	----	----	----	23
22	80	325	----	----	----	----	----	----
----	40	----	----	300	7. 0	6. 0	275	----
----	----	----	----	----	----	----	----	18
----	----	----	----	----	----	----	----	16
----	70	325	----	----	----	----	----	----

[3] This nonirrigated wheat is high in protein and used mainly for making flour.

[4] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single grazing season without injury to the sod. An acre of pasture that provides 30 days of grazing for two cows has a carrying capacity of 60 cow-acre-days.

[5] This soil is used for fruit production. Hail, and sometimes insects, damage this soil and cause partial or complete loss of crops.

The mean annual temperature is 36° to 45° F. Elevations range from about 5,000 to 8,000 feet.

There are five range sites in the Mountain climatic zone. These are Mountain Clay, Mountain Loam, Mountain Loam (Shrub), Mountain Shallow Loam, and Mountain Stony Loam.

High Mountain Climatic Zone.—The average annual precipitation ranges from 22 to 35 inches and occurs mostly as snow in winter. The growing season generally is from about May 15 to about September 20, or until the first killing frost of the fall. High mountain sites occur on all exposures and slopes. The mean annual temperature is 35° to 42° F. Elevations range from 7,000 to 9,000 feet.

The range site in the High Mountain climatic zone is High Mountain Loam (Aspen). This site is covered mainly by aspen but is grazable to some extent.

Wet and Semiwet Climatic Zone.—In this climatic zone the soils are wet because they receive run-in water or have a high water table. In these areas the climate is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 12 to 16 inches. Most of the water available to plants is from run-in water from adjacent irrigated land or from the water table. The growing season is from about April 15 to about September 1 or until frost. The frost-free period is about 120 to 150 days. The mean annual temperature is about 45° F.

Range sites in the Wet and Semiwet climatic zone are Alkali Bottom, Salt Meadow, Semiwet Meadow, and Wet Meadow.

Descriptions of the range sites

To help ranchers in the survey area evaluate their range, all the soils that are still in range have been grouped in range sites and the climax plants are listed for each site. Plant species most likely to invade are also shown. In addition, an estimate of the potential annual production of air-dry vegetation is indicated for each site. The range sites are described in the following pages, and the climatic zone is given for each site. The names of the soil series represented are mentioned in the range site, but this does not mean that all the soils of a given series are in that site. To find the names of all the soils in any given site, refer to the "Guide to Mapping Units" at the back of this survey.

DESERT FLATS RANGE SITE

This range site is on the lake plains and low lake terraces in the Desert climatic zone. Slopes are 0 to 6 percent but most commonly are 0 to 2 percent. The average annual precipitation ranges from 6 to 8 inches.

The soils in this site are well drained and moderately well drained. The surface layer is silt loam. The underlying layers are silty clay loam or silt loam. Soils of the Drum and Uffens series are in this site.

These soils are slightly to strongly affected by salts and are moderately to strongly affected by alkali. They absorb water at a slow to moderate rate. Because of the salt content, the water available to plants is only about 3 to 7 inches. The water-supplying capacity is about 4 to 6 inches before moisture is depleted. If the soils were reclaimed, the available water holding capacity would be 10 to 12 inches to a depth of 5 feet. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Most roots are in the top 18 inches of soil.

The approximate composition of the climax (potential) plant community for the Desert Flats range site is:

	Percentage by weight		*Percentage by weight*
Indian ricegrass	4	Greasewood [1]	28
Squirreltail	1	Shadscale	22
Other grasses	1	Winterfat	40
Forbs	4		
		Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,200 to 1,400 pounds per acre in favorable years and from 500 to 700 pounds per acre in less favorable years. About 70 percent of this production is from plants that furnish forage for wildlife and livestock.

If this site is in poor condition, the plant cover is mostly greasewood, shadscale, and halogeton.

Proper grazing use is the only range practice needed.

SEMIDESERT ALKALI FLATS RANGE SITE

This range site is on low lake terraces and lake plains in the Semidesert climatic zone. The soils are in the Bram, Harding, Mellor, Pogal, and Thiokol series. Slopes are 0 to 6 percent but most commonly are less than 1 percent. Average annual precipitation is 8 to 11 inches, except on the Pogal soils, where it is 11 to 13 inches.

The soils in this site are well drained and moderately well drained. The surface layer is dominantly silt loam. The underlying layers and subsoil are silty clay, silty clay loam, and silt loam.

These soils are moderately to strongly affected by salts and alkali. They absorb water at a slow to moderate rate. Because of the high salt content, the water available to plants is only about 3 to 7 inches. The water-supplying capacity before moisture is depleted is about 5.5 to 8 inches, except in the Pogal soils, where it is 8.5 to 10.5 inches. If the soils are reclaimed, the available water holding capacity is 9 to 12 inches to a depth of 5 feet. Permeability is slow to moderate. Runoff is medium, and the hazard of erosion is moderate. Sheet erosion is active, and in some places shallow gullies have been formed. Most roots are in the upper 18 to 30 inches of soil, except in the Pogal soil, where roots penetrate to a depth of 60 inches or more. The Pogal soils commonly have windblown hummocks.

The approximate composition of the climax (potential) plant community for the Semidesert Alkali Flats range site is:

	Percentage by weight		*Percentage by weight*
Globemallow	1	Shadscale	25
Squirreltail	31	Winterfat	2
Western wheatgrass	6	Greasewood [1]	30
Indian ricegrass	3	Other shrubs [1]	2
		Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,300 to 1,700 pounds per acre in favorable years and from 800 to 1,000 pounds per acre in less favorable years. About 75 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly greasewood, shadescale, and other shrubs.

Proper grazing use is generally the only conservation practice needed. Plowing and reseeding may be feasible, however, in some areas of these soils if extra water is available.

SEMIDESERT LOAM RANGE SITE

This range site is on lake terraces in the Semidesert climatic zone. Slopes are 0 to 10 percent but most commonly are 1 to 3 percent. The average annual precipitation ranges from 8 to 11 inches.

The soils in this site are well drained. The surface layer is silt loam. The subsoil and underlying layers are silt loam, loam, or very fine sandy loam. Soils of the Palisade and Thiokol series are in this site.

These soils absorb water at a moderate rate. The available water holding capacity is commonly about 8 to 12 inches to a depth of 5 feet. In the Palisade soils, however, the water available to plants is reduced to about 4 to 8 inches because of the salt content, and the water-supplying capacity is about 6 to 8 inches before moisture is depleted. Permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Roots pene-

trate to a depth of 60 inches, but most roots are in the top 30 to 40 inches of soil.

The approximate composition of the climax (potential) plant community for the Semidesert Loam range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	33	Hawksbeard	2
Sandberg bluegrass	10	Other forbs [1]	5
Squirreltail	5	Winterfat	10
Needle-and-thread	5	Big sagebrush [1]	10
Indian ricegrass	5	Other shrubs [1]	10
Other grasses	2		
Phlox	3	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,000 to 1,350 pounds per acre in favorable years and from 300 to 600 pounds per acre in less favorable years. About 75 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs.

Conservation practices for this site are proper range use and a grazing system that stresses periodic nonuse early in spring.

SEMIDESERT SAND RANGE SITE

This range site is on low lake terraces and in slightly elevated, beachline areas on the edge of salt playas bordering the Great Salt Lake. Average annual precipitation is 8 to 10 inches.

Etil loamy sand, 1 to 6 percent slopes, is the only soil in this site. This soil is moderately well drained. In most places its slopes are less than 2 percent. Depth to the water table ranges from 24 inches near edge of playas to more than 60 inches in slightly elevated areas. This soil is made up mainly of oolitic sand. The surface layer is loamy sand, and the underlying layers are sand and coarse sand.

This soil absorbs water very rapidly. The available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity is 4 to 5.5 inches before moisture is depleted. Permeability is rapid. Runoff is slow, and the hazard of erosion is slight. This soil commonly has windblown hummocks. Roots may penetrate to a depth of more than 60 inches.

The approximate composition of the climax (potential) plant community for the Semidesert Sand range site is:

	Percentage by weight		Percentage by weight
Needle-and-thread	14	Big sagebrush [1]	15
Western wheatgrass	1	Yellowbrush [1]	5
Indian ricegrass	47	Other shrubs	5
Other grasses	3		
Forbs [1]	10	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 700 to 1,100 pounds per acre in favorable years and from 400 to 700 pounds per acre in less favorable years. About 75 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs. Brush control and proper grazing use are the range conservation practices needed.

SEMIDESERT SHALLOW LOAM RANGE SITE

This range site is on lake terraces, terrace escarpments, and mountain foot slopes in the Semidesert climatic zone. Slopes are 1 to 30 percent but most commonly are 10 to 30 percent. Average annual precipitation is 8 to 11 inches.

The soils in this site are well drained. The surface layer is extremely stony silt loam or extremely stony loam, the underlying layers are very cobbly silt loam, and the content of coarse fragments is 40 to 75 percent. More than 50 percent of the surface is covered with basalt stones that range from 1 to 6 feet across. In this site are soils of the Saxby and Thiokol series and Very stony land. Saxby soils are 17 to 20 inches deep over bedrock or extremely stony material.

The soils in this site absorb water slowly. The available water holding capacity is about 2 or 3 inches. The water supplying capacity before moisture is depleted is about 3 to 5 inches. Permeability is moderate. Runoff is medium and the hazard of erosion is moderate. Roots penetrate to bedrock.

The approximate composition of the climax (potential) plant community for the Semidesert Shallow Loam range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	30	Other forbs	5
Sandberg bluegrass	5	Black sagebrush	10
Indian ricegrass	10	Big sagebrush [1]	5
Squirreltail	5	Yellowbrush [1]	5
Other grasses	5	Other shrubs [1]	10
Phlox	5		
Hawksbeard	5	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 800 to 1,400 pounds per acre in favorable years and from 300 to 600 pounds per acre in less favorable years. About 70 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs and annuals.

Proper grazing use is the main conservation practice needed.

SEMIDESERT STONY LOAM RANGE SITE

This range site is on low lake terraces and terrace escarpments in the Semidesert climatic zone. Average annual precipitation is 8 to 11 inches.

Sanpete gravelly silt loam, 6 to 30 percent slopes, is the only soil in this site. This soil is somewhat excessively drained. The surface layer is gravelly silt loam, and the underlying layers and subsoil are very gravelly silt loam and very gravelly sandy loam. The content of coarse fragments is 20 to 80 percent.

This soil absorbs water readily. The available water holding capacity is 4 to 5.5 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 4 to 9 inches. Permeability is moderately rapid. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet erosion is common, and in some places shallow gullies have been formed. Most roots are in the top 30 inches of the soil.

The approximate species composition of the climax (potential) plant community for Semidesert Stony Loam range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	40	Other forbs	5
Indian ricegrass	10	Big sagebrush [1]	10
Squirreltail	2	Black sagebrush	5
Sandberg bluegrass	3	Yellowbrush [1]	2
Other grasses	5	Shadscale	3
Balsamroot	2	Other shrubs [1]	10
Phlox	2		
Hawksbeard	1	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,000 to 1,350 pounds per acre in favorable years and from 400 to 600 pounds per acre in less favorable years. About 80 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs.

Conservation practices for this site are proper range use and a planned grazing system that stresses periodic nonuse early in spring.

UPLAND LOAM RANGE SITE

This range site is on terraces, terrace escarpments, alluvial fans, foothills, and mountain slopes in the Upland climatic zone. Slopes are 1 to 70 percent, but most of the soils have slopes of 1 to 30 percent. Average annual precipitation ranges from 11 to 18 inches.

The soils in this site are well drained. The surface layer ranges from silty clay loam to loam and from gravelly or cobbly silt loam to gravelly or cobbly loam. The subsoil or underlying layers are clay to fine sandy loam and, in some places, are very gravelly to very cobbly. Soils in this site are of the Forsgren, Gemson, Kearns, Kidman, Middle, Munk, Parleys, Pomat, Stingal, and Windmill series. Also in the site is Rock outcrop and Rough broken land. The Middle soils are 24 to 38 inches deep over bedrock. Roots generally extend to a depth of 60 inches, but in the Middle soils they extend to bedrock.

Soils in this site absorb water at a slow to moderate rate. The available water holding capacity ranges from about 5 to 12 inches to a depth of 5 feet or to bedrock. For the gravelly or cobbly soils, the range is from 5 to 7 inches. The water-supplying capacity is about 6 to 14 inches before moisture is depleted. Permeability ranges from slow to moderately rapid. Runoff is slow to very rapid. The hazard of erosion is slight to very high. In places, moderate sheet and rill erosion is common and a few shallow gullies have been formed.

The approximate composition of the climax (potential) plant community for the Upland Loam site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	43	Lupine	1
Great Basin wildrye	5	Peavine	2
Indian ricegrass	10	Other forbs [1]	3
Prairie junegrass	2	Big sagebrush	4
Sandberg bluegrass	5	Bitterbrush	2
Tall native bluegrass	2	Mormon tea	1
Western wheatgrass	5	Rubber rabbitbrush [1]	1
Other grasses	3	Yellowbrush [1]	2
Aster [1]	1	Other shrubs [1]	5
Astragalus [1]	1		
Balsamroot	1	Total	100
Drummond thistle [1]	1		

These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,300 to 2,500 pounds per acre in favorable years and from 550 to 1,300 pounds per acre in less favorable years. Approximately 85 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs and forbs. If the site is in good or excellent condition, proper grazing use may be the only practice needed to maintain maximum production (fig. 17). Where the soils have slopes of less than 30 percent, brush control and range seeding also may be needed. Alfalfa seeded in alternate rows with crested wheatgrass or Siberian wheatgrass proves valuable where range seeding is done.

Most of the Upland Loam range site has been plowed and is used for nonirrigated crops.

UPLAND SHALLOW LOAM RANGE SITE

This range site is on terraces, terrace escarpments' foothills, and mountain slopes in the Upland climatic zone. Slopes are 6 to 70 percent, but about half the acreage has slopes of 30 to 70 percent. Average annual precipitation is 12 to 17 inches.

The soils in this site are well drained to excessively drained. The surface layer is silt loam or loam to very fine sandy loam and, in some places, is gravelly, very gravelly, or stony. In some places the surface is covered with a few large stones or rock outcrops.

The underlying layers range from silt loam to cobbly clay and to very gravelly or very cobbly very fine sandy loam. Content of coarse fragments ranges from 0 to more than 50 percent. Soils in this site are the Collinston, Middle, Pass Canyon, Richmond, Snowville, and Wheelon soils and the Wheelon soils, shallow variant. Nearly all of these soils are 10 to 20 inches deep over bedrock or a hardpan, but the Wheelon soils are more than 60 inches deep.

Soils in this site absorb water slowly to readily. The available water holding capacity is generally about 1.5 to 4.5 inches above the bedrock or hardpan, but in the

Figure 17.—**Mainly bluebunch wheatgrass growing on Middle cobbly silt loam, 10 to 30 percent slopes. This soil is in the Upland Loam range site.**

Wheelon soils it is 9 to 11 inches to a depth of 5 feet. Some roots penetrate into cracks of the bedrock and get additional water. The water-supplying capacity before moisture is depleted is about 4 to 6 inches in the shallow soils but it is 11 to 14 inches in the Wheelon soils. Permeability is moderately slow to moderately rapid above the hardpan or over bedrock. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. Sheet erosion is commonly moderate, and in some places many shallow gullies have been formed.

The approximate composition of the climax (potential) plant community for the Upland Shallow range site is:

	Percentage by weight		*Percentage by weight*
Bluebunch wheatgrass	50	Big sagebrush [1]	10
Sandberg bluegrass	6	Bitterbrush	5
Other grasses	4	Low sagebrush [1]	10
Balsamroot	3	Woody phlox [1]	3
Phlox [1]	2	Yellowbrush [1]	2
Other forbs	5		
		Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,750 to 2,500 pounds per acre in favorable years and from 700 to 1,500 pounds per acre in unfavorable years. Approximately 75 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs, particularly low sagebrush.

Proper grazing use and brush control are the only conservation practices needed.

UPLAND STONY HILLS (JUNIPER) RANGE SITE

This range site is on alluvial fans, mountain foot slopes, and mountain slopes in the Upland climatic zone. Slopes are 10 to 70 percent but most commonly are 30 to 60 percent. Average annual precipitation ranges from 11 to 15 inches.

The soils in this site are well drained and somewhat excessively drained. These soils are 12 to 40 inches deep over bedrock. The surface layer and underlying layers range mainly from cobbly silt loam to very cobbly loam or very gravelly loam or silt loam. These layers are 35 to 80 percent coarse fragments. Soils in this site are of the Promo, Rozlee, and Sandall series (fig. 18). Also included in this unit are areas of Rock outcrop.

These soils absorb water slowly to readily. The available water holding capacity is about 2 to 5 inches to bedrock. The water-supplying capacity before moisture is depleted is about 4 to 8 inches. Permeability is moderate to moderately rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Sheet and rill erosion is commonly moderate, and in some places many shallow gullies have been formed.

The approximate composition of the climax (potential) plant community for the Upland Stony Hills (Juniper) range site is:

	Percentage by weight		*Percentage by weight*
Bluebunch wheatgrass	50	Other forbs	3
Indian ricegrass	5	Juniper [1]	30
Other grasses	5	Big sagebrush [1]	2
Phylox	1	Yellowbrush [1]	2
Hawksbeard	1	Other shrubs [1]	1
		Total	100

[1] These plants show little or no use by livestock.

Figure 18.—Juniper growing on a Sandall cobbly silt loam. This soil is in Upland Stony Hills (Juniper) range site.

On this site the potential annual yield of air-dry herbage ranges from about 1,500 to 1,700 pounds per acre in favorable years and from 800 to 1,200 pounds per acre in less favorable years. About 60 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs and trees. Grasses may be missing.

Proper grazing use, chaining juniper, and brush control and seeding are the conservation practices needed.

UPLAND STONY LOAM RANGE SITE

This range site is on alluvial fans, lake terraces, terrace escarpments, foothills, and mountain slopes in the Upland climatic zone. Slopes are 1 to 70 percent. Most of the soils having slopes of less than 30 percent have been plowed and are used for nonirrigated crops. Average annual precipitation ranges from 11 to 18 inches.

The soils in this site are well drained to somewhat excessively drained. The surface layer ranges mainly from gravelly or cobbly silt loam or gravelly loam to cobbly sandy loam. Some of the soils are stony. The subsoil or underlying layers range mainly from gravelly loam to gravelly or very gravelly sandy loam but, in some places, are very cobbly clay loam or very cobbly loam. Content of coarse fragments is mainly 35 to 75 percent. Soils in this site are in the Abela, Blue Star, Hupp, Kapod, Kilburn, Munk, Parleys, Ridd, Sanpete, and Sterling series and Stony alluvial land. The Munk and Ridd soils have bedrock at a depth of 24 to 40 inches.

Soils in this range site absorb water readily. The available water holding capacity is about 4.5 to 7 inches to a depth of 5 feet or to bedrock. The water-supplying capacity before moisture is depleted is about 5 to 9 inches. Permeability is moderate to rapid. Runoff is slow to very

rapid. The hazard of erosion is slight to high. Moderate sheet and rill erosion is common, and a few shallow gullies have been formed.

The approximate composition of the climax (potential) plant community for the Upland Stony Loam range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	62	Birchleaf mountain-mahogany	2
Indian ricegrass	3	Bitterbrush	3
Other grasses	5	Black sagebrush	10
Balsamroot	2	Shadscale [1]	5
Phlox [1]	1		
Other forbs [1]	2		
Big sagebrush [1]	5	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,400 to 2,300 pounds per acre in favorable years and from 750 to 1,400 pounds per acre in unfavorable years. Approximately 85 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly big sagebrush, yellowbrush, other shrubs, and some juniper.

Conservation practices suitable on this site are brush control and proper grazing use. Proper grazing use may be the only practice needed if the range is in good or excellent condition. On soils where slopes are less than 30 percent, seeding alfalfa and crested wheatgrass or Siberian wheatgrass in alternate rows may be needed if the range is in fair or poor condition.

UPLAND SAND RANGE SITE

This range site is on lake terraces, terrace escarpments, mountain foot slopes, and alluvial fans in the Upland climatic zone. Slopes are 6 to 70 percent but most commonly are 6 to 25 percent. Average annual precipitation ranges from 11 to 18 inches.

The soils in this site are well drained to excessively drained and are gravelly. The surface layer is mainly gravelly loam. The underlying layers are gravelly sandy loam to very gravelly sand or very cobbly sand. The content of coarse fragments ranges from 20 to 80 percent. Soils in this site are in the Blue Star, Sheeprock, and Wasatch series and the Wasatch series, gravelly subsoil variant.

These soils absorb water quite rapidly. The available water holding capacity is 2.5 to 7 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is about 5 to 9 inches. Permeability is rapid to moderately rapid. Runoff is slow to medium. The hazard of water erosion is slight to high, and the hazard of soil blowing is moderate to severe. Most roots are in the top 30 inches of soil.

The approximate composition of the climax (potential) plant community for the Upland Sand range site is:

	Percentage by weight		Percentage by weight
Needle-and-thread	5	Globemallow	2
Indian ricegrass	30	Phlox	3
Tall native bluegrass	5	Other forbs	5
Sand dropseed	20	Big sagebrush [1]	10
Western wheatgrass	5	Other shrubs [1]	5
Other grasses	10		
		Total	100

[1] These plants show little or no use by livestock.

On this site the annual yield of air-dry herbage ranges from approximately 800 to 1,000 pounds per acre in favorable years and from 400 to 700 pounds per acre in less favorable years. About 80 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly three-awn, cheatgrass, and rubber rabbitbrush.

Proper grazing use and seeding are suitable conservation practices in the more favorable locations.

MOUNTAIN CLAY RANGE SITE

This range site is on alluvial fans and small valley bottoms in the Mountain climatic zone. Slopes are mainly 10 to 25 percent. Swelling and cracking of the soil have made the soil surface irregular in most areas. Average annual precipitation is 18 to 25 inches.

Obray clay, 10 to 25 percent slopes, is the only soil in this range site. This soil is well drained. The surface layer and underlying layers are dominantly clay.

This soil absorbs water slowly. The available water holding capacity is 11 to 13 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 14 to 21 inches. Permeability is very slow. Runoff is rapid, and the hazard of erosion is high. In some places a few shallow gullies have been formed.

The approximate composition of the climax (potential) plant community for the Mountain Clay range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	5	Forbs [1]	5
Columbia needlegrass	3	Bitterbrush	1
Great Basin wildrye	5	Big sagebrush [1]	1
Idaho fescue	10	Serviceberry	2
Slender wheatgrass	50	Other shrubs [1]	3
Western wheatgrass	5		
Other grasses	10	Total	100

[1] These plants generally have little or no use by livestock.

On this site the annual yield of air-dry herbage ranges from approximately 1,800 to 3,500 pounds per acre in favorable years and from 1,500 to 1,700 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly mulesear dock and low sagebrush.

Spraying for the control of dock and brush is a good conservation practice on this site.

MOUNTAIN LOAM RANGE SITE

This range site is on mountain slopes and alluvial fans in the Mountain climatic zone. Slopes are 0 to 60 percent but are mainly 10 to 40 percent. Average annual precipitation ranges from 16 to 26 inches.

The soils in this site are well drained. The surface layer is clay loam, loam, or gravelly loam. The subsoil or underlying layers are mainly clay or silty clay but in places are very gravelly loam. The content of coarse fragments is 0 to 80 percent. Soils in this range site are in the Goring, Manila, and Picayune series and the Goring series, brown subsoil variant.

These soils absorb water at a moderate to slow rate. The available water holding capacity is 11 to 12 inches to a depth of 5 feet, except for the Picayune soils, in which it is only 6 to 8 inches. The water-supplying capacity before moisture is depleted is about 12 to 22 inches. Permeability

is slow to rapid. Runoff is slow in the more nearly level areas but ranges to rapid where the slopes are very steep. The hazard of erosion is slight to moderate except on the very steep soils, where it is high. Except for the Picayune soils, the soils in this site commonly have cracks that range from ½ to 1 inch wide and extend to a depth of about 36 inches. During periods of rapid rainfall, runoff carries a large amount of silt from the Picayune soils if they are not protected. Roots penetrate to a depth of 48 to 60 inches in the soils of this site.

The approximate composition of the climax (potential) plant community for the Mountain Loam range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	61	Big sagebrush [1]	2
Great Basin wildrye	3	Snowberry	1
Tall native bluegrass	6	Yellowbrush [1]	1
Other grasses	15	Other shrubs [1]	2
Forbs	5		
Bitterbrush	4	Total	100

[1] These plants show little or no use by livestock.

On this site the annual yield of air-dry herbage ranges from approximately 1,750 to 2,750 pounds per acre in favorable years and from 1,650 to 1,750 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs and broadleaf forbs.

In the more nearly level areas of this site, brush control and seeding are profitable conservation practices. In the steep areas, spraying brush and proper grazing use are needed.

MOUNTAIN LOAM (SHRUB) RANGE SITE

This range site is dominantly on east-facing and north-facing mountain slopes and in small canyons or along drainageways in the Mountain climatic zone. Slopes are 25 to 70 percent. Average annual precipitation ranges from 17 to 26 inches.

The soils in this site are well drained. The surface layer is silt loam or loam. The subsoil or underlying layers are dominantly gravelly clay or cobbly clay that is 10 to 80 percent coarse fragments. Soils in this site are in the Elzinga, Maughan, and Smarts series.

These soils absorb water at a moderate to slow rate. The available water holding capacity is about 7 to 11 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is about 13 to 21 inches. Permeability is slow to moderate. Runoff is medium, and the hazard of erosion is moderate.

The approximate composition of the climax (potential) plant community for Mountain Loam (Shrub) range site is:

	Percentage by weight		Percentage by weight
Bearded wheatgrass	3	Other forbs [1]	9
Bluebunch wheatgrass	33	Big sagebrush [1]	2
Great Basin wildrye	8	Bitterbrush	2
Western wheatgrass	3	Maple	20
Other grasses	10	Other shrubs	5
Balsamroot	2		
Little sunflower	3	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 2,400 to 3,000 pounds per acre in favorable years and from 1,500 to 2,000 pounds per acre in less favorable years. About 70 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs, especially maple and chokecherry.

Generally, brush spraying and proper grazing use are the only conservation practices feasible. After the brush is controlled, seeding may be possible in the more nearly level areas of this site.

MOUNTAIN SHALLOW LOAM RANGE SITE

This range site is most commonly on south-facing and west-facing mountain slopes and ridgetops in the Mountain climatic zone. Slopes are 30 to 70 percent. Average annual precipitation ranges from 18 to 26 inches.

The soils in this range site are 10 to 20 inches deep over bedrock. They are somewhat excessively drained. The surface layer is gravelly loam to very stony loam, and the underlying layers are very gravelly to very cobbly loam. The content of coarse fragments is 25 to 95 percent. In this site are soils of the Agassiz and Foxol series and Rock outcrop.

These soils absorb water slowly. The available water holding capacity is 2 or 3 inches above the bedrock. The water-supplying capacity before moisture is depleted is about 5 to 9 inches. Permeability is moderate. Runoff is moderate to rapid, and the hazard of erosion is moderate to high. Roots extend to bedrock.

The approximate composition of the climax (potential) plant community for Mountain Shallow Loam range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	20	Bitterbrush	15
Great Basin wildrye	10	Big sagebrush [1]	8
Indian ricegrass	2	Oakbrush [1]	3
Tall native bluegrass	3	Serviceberry	3
Other grasses	8	Yellowbrush [1]	3
Balsamroot	5	Other shrubs [1]	5
Other forbs [1]	10		
Birchleaf mountain-mahogany	5	Total	100

[1] These plants have little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,250 to 1,750 pounds per acre in favorable years and from 550 to 1,000 pounds per acre in less favorable years. Approximately 80 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is almost entirely shrubs and forbs.

Spraying for brush control is commonly beneficial on this site.

MOUNTAIN STONY LOAM RANGE SITE

This range site is most commonly on mountain slopes in the Mountain climatic zone. Slopes are 10 to 60 percent. Average annual precipitation ranges from 16 to 25 inches.

Soils in this site are well drained and are gravelly, cobbly, and stony. The surface layer ranges from gravelly or cobbly clay loam to gravelly or cobbly loam. The subsoil or underlying layers range from very gravelly clay to very cobbly clay loam. The content of coarse fragments is 10 to 85 percent. Soils in this site are in the Broad and Yeates Hollow series. The Broad soil is 30 to 40 inches

deep to bedrock, and the Yeates Hollow soil is more than 60 inches deep.

These soils absorb water at a moderate to slow rate. The available water holding capacity is about 4 to 7 inches to a depth of 5 feet or to bedrock. The water-supplying capacity before moisture is depleted is about 6.5 to 11 inches. Permeability is slow to moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Roots penetrate to a depth of 60 inches in the Yeates Hollow soil and to bedrock in the Broad soil.

The approximate composition of the climax (potential) plant community for the Mountain Stony Loam range site is:

	Percentage by weight		Percentage by weight
Bluebunch wheatgrass	40	Birchleaf mountain-mahogany	3
Great Basin wildrye	5	Bitterbrush	10
Other grasses	10	Big sagebrush [1]	10
Desirable forbs	5	Serviceberry	10
Undesirable forbs [1]	5	Other shrubs	2
		Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,750 to 2,500 pounds per acre in favorable years and from 750 to 1,000 pounds per acre in less favorable years. Approximately 75 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs. Big sagebrush and invading juniper trees are dominant.

Conservation practices that are feasible are spraying for brush control and proper grazing use.

HIGH MOUNTAIN LOAM (ASPEN) RANGE SITE

This range site is on north-facing mountain slopes at high elevations in the High Mountain climatic zone. Average annual precipitation ranges from 22 to 28 inches.

Lucky Star silt loam, 25 to 40 percent slopes, is the only soil in this range site. This soil is well drained. The surface layer is silt loam, and the subsoil is gravelly clay loam that is 15 to 65 percent cobblestones and gravel throughout.

This soil absorbs water readily. The available water holding capacity is 7 to 9 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 13 to 19 inches. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. Roots extend to a depth of more than 60 inches.

The approximate composition of the climax (potential) plant community for High Mountain Loam (Aspen) range site is:

	Percentage by weight		Percentage by weight
Bearded wheatgrass	5	Peavine	4
Blue wildrye	10	Sweetanise	3
Dryland sedge	2	Tall larkspur [1]	1
Mountain brome	20	Western coneflower	1
Nodding brome	3	Other forbs	6
Other grasses	3	Aspen [1]	30
Butterweed	4	Shrubs	3
Cowcabbage	1		
Edible valerian	4	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from 4,500 to 5,300 pounds per acre in favorable years and from 1,800 to 3,200 pounds per acre in less favorable years. Approximately 70 percent of this production is from plants that furnish forage for wildlife and livestock.

If this site is in poor condition, the plant cover is mostly forbs and shrubs, and the growth of aspen greatly increases.

Clearcutting of aspen greatly increases the production of this range site. Important practices are proper grazing use and the protection of aspen sprouts from excessive grazing until the trees have grown to a height of more than 5 feet.

ALKALI BOTTOM RANGE SITE

This range site is on low terraces, lake plains, and flood plains in the Wet and Semiwet climatic zone. Slopes are 0 to 3 percent but most commonly are 0 to 1 percent. Average annual precipitation ranges from 11 to 17 inches.

The soils in this site are mainly somewhat poorly drained and poorly drained, but some areas are moderately well drained. The surface layer ranges from silty clay loam to fine sandy loam, and the subsoil or underlying layers range from silty clay to loamy sand. Soils in this site are in the Airport, Fridlo, Greenson, Kirkham, Lasil, Magna, Payson, Placeritos, Refuge, Saltair, Stokes, Syracuse, and Warm Springs series.

These soils absorb water quite slowly to readily. Most of the soils are moderately to strongly affected by salts and alkali. The water-holding capacity is about 8 to 12 inches to a depth of 5 feet, but in most of the soils the water available to plants is reduced to about 3 to 9 inches because of the salt content. Permeability is very slow to moderate. Runoff is slow to ponded, and the hazard of erosion is slight to none. Depth to the water table fluctuates with the season. In most places the water table is at a depth of 20 to 40 inches or, if the soils are drained, at a depth of more than 40 inches. The Kirkham and Placeritos soils are subject to flooding and overflow, and in these soils the water table is near the surface for many weeks in spring.

The approximate composition of the climax (potential) plant community for the Alkali Bottom range site is:

	Percentage by weight		Percentage by weight
Alkali bluegrass	13	Wiregrass	5
Alkali cordgrass	5	Sedges	10
Alkali sacaton	10	Forbs	1
Creeping wildrye	2	Big rabbitbrush [1]	2
Great Basin wildrye	5	Four-wing saltbrush	5
Tufted hairgrass	5	Graymolly	2
Other grasses and grass-like plants [1]	5	Greasewood [1]	5
Saltgrass	25	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,700 to 2,500 pounds per acre in favorable years and from 650 to 1,000 pounds per acre in less favorable years. About 90 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mainly greasewood and rubber rabbitbrush.

Proper grazing use is the main practice for range improvement. Also, this site can be improved by providing drainage and water management.

SALT MEADOW RANGE SITE

This range site is on low lake terraces, lake plains, and flood plains in the Wet and Semiwet climatic zone. Slopes are 0 to 1 percent. The average annual precipitation ranges from 11 to 16 inches.

Soils in this range site are dominantly poorly drained. The surface layer ranges from silty clay loam to fine sandy loam. The subsoil and underlying layers range from silty clay to fine sandy loam. Soils in this site are in the Arave, Gooch, Lakeshore, Logan, and Woods Cross series.

The soils in this site are moderately to very strongly affected by salts and alkali. They absorb water slowly. Although the water-holding capacity is about 10 to 12 inches, the water available to plants is only about 3 to 8 inches because of the high salt content, except in the Woods Cross soils, which hold about 7 to 9 inches of water available for plant growth. Permeability is slow to moderately slow. Runoff is slow or ponded, and the hazard of erosion is none to slight. Most roots are in the top 18 to 24 inches of soil. Generally, the water table is within 20 inches of the surface.

The approximate composition of the climax (potential) plant community for Salt Meadow range site is:

	Percentage by weight		Percentage by weight
Saltgrass	14	Daisy [1]	2
Baltic rush	1	Aster [1]	1
Alkali sacaton	52	Other forbs [1]	1
Arrowgrass	2	Greasewood [1]	2
Pickleweed [1]	19		
Owl clover [1]	6	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,200 to 1,400 pounds per acre in favorable years and from 750 to 1,000 pounds per acre in less favorable years. Approximately 75 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly greasewood and saltgrass, and invaders such as curlycup gumweed, cheatgrass, povertyweed, and Russian-thistle are present.

Proper grazing use is the main conservation practice for range improvement. Also, this range site can be improved by providing drainage and water management.

SEMIWET MEADOW RANGE SITE

This range site is on alluvial fans, low river terraces, and flood plains in the Wet and Semiwet climatic zone. Slopes are 0 to 3 percent but most commonly are 0 to 1 percent.

The soils in this site are moderately well drained or somewhat poorly drained. The surface layer ranges from loam to fine sandy loam and the underlying layers from loam to loamy fine sand. Soils in this site are in the James Canyon and Martini series. The James Canyon soils generally are gravelly below a depth of 36 inches, where the content of coarse fragments ranges from 30 to 70 percent.

The soils in this site absorb water at a moderate to rapid rate. Available water holding capacity is about 6 to 10 inches to a depth of 5 feet. Permeability is moderate to moderately rapid. Runoff is slow, and the hazard of erosion is slight to none. The water table is most commonly at a depth between 20 and 48 inches. In some places the Martini soils are slightly to moderately affected by salts and alkali. These soils are subject to flooding and overflow in spring, and streambank cutting is common.

The approximate composition of the climax (potential) plant community for the Semiwet Meadow range site is:

	Percentage by weight		Percentage by weight
Alkali sacaton	5	Geranium	2
Great Basin wildrye	8	Peavine	2
Idaho fescue	5	Yarrow [1]	2
Sedges	5	Other forbs [1]	4
Slender wheatgrass	25	Rose	1
Tall native bluegrass	5	Shrubby cinquefoil [1]	1
Tufted hairgrass	10	Silver sagebrush [1]	1
Western wheatgrass	5	Willows [1]	1
Other grasses and grasslike plants	17	Yellowbrush [1]	1
		Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 1,750 to 4,200 pounds per acre in favorable years and from 1,000 to 1,700 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly silver sagebrush, yellowbrush, Kentucky bluegrass, and western wheatgrass.

Proper grazing use is the main practice for range improvement. Also, this range site can be improved by providing drainage and water management.

WET MEADOW RANGE SITE

This range site is on low lake terraces, on flood plains, and in nearly level depression areas in the Wet and Semiwet climatic zone. Slopes range from 0 to 3 percent but most commonly are 0 to 1 percent. Average annual precipitation ranges from 12 to 17 inches.

The soils in this site are somewhat poorly drained to very poorly drained. The surface layer is silty clay loam or silt loam and is rather high in content of organic matter. The underlying layers range from silty clay to silt loam. Soils in this range site are in the Collett, Cudahy, Logan, Peteetneet, Roshe Springs, and Woods Cross series. The Peteetneet soils have a surface layer of peat, and the underlying layers are peat and muck to a depth of 18 to 36 inches. The Cudahy soils have a cemented hardpan at a depth of 23 to 40 inches.

The soils in this site absorb water quite slowly to readily. The available water holding capacity is 10 to 13 inches to a depth of 5 feet, except in the Cudahy soils, where the available water holding capacity is only 4 to 6 inches above the hardpan. Permeability is very slow to moderate. Runoff is slow to ponded, and the hazard of erosion is slight to none. In most places the water table is within 20 to 40 inches of the surface at least part of the time. In some places the water table is only about 12 inches below the surface.

The approximate composition of the climax (potential) plant community for the Wet Meadow range site is:

	Percentage by weight		Percentage by weight
Sedges	40	Native clover [1]	1
Tufted hairgrass	24	Other forbs [1]	2
Wiregrass	10	Willows [1]	1
Other grasses and grasslike plants	20	Other shrubs [1]	1
Cinquefoil	1	Total	100

[1] These plants show little or no use by livestock.

On this site the potential annual yield of air-dry herbage ranges from approximately 4,000 to 6,500 pounds per acre in favorable years and from 3,000 to 3,500 pounds per acre in unfavorable years. Approximately 95 percent of this production is from plants that furnish forage for livestock and wildlife.

If this site is in poor condition, the plant cover is mostly shrubs and grasses.

Proper grazing use is the main conservation practice for range improvement. Also, providing drainage and water management increases the production of this site.

Use and Management of the Soils for Wildlife

This section shows, in a general way, the relationships between soils, and plants, and water developments that produce a kind of wildlife habitat. The four kinds of habitat considered are openland habitat, woodland habitat, wetland habitat, and rangeland habitat. Each of these has a certain potential for growing specific kinds of plants or for water developments needed by certain kinds of wildlife.

Openland habitat.—These areas are mainly cropland, pasture, meadows, lawns, and other areas overgrown with grasses, forbs, shrubs, and vines. Examples of birds and mammals generally common to these areas are California quail, gray partridge, mourning dove, ring-necked pheasant, black-tailed jackrabbit, cottontail rabbit, California gull, goose, prairie falcon, weasel, antelope, woodchuck, skunk, and songbirds.

Woodland habitat.—These are wooded areas containing either hardwood or coniferous trees and shrubs or a mixture of these. Examples of birds and mammals generally common to these areas are songbirds, ground squirrel, porcupine, mule deer, bobcat, coyote, ring-necked pheasant, and weasel.

Wetland habitat.—These are mainly swampy, marshy, or open-water areas. Examples of birds and mammals generally common to these areas are white pelican, duck, goose, beaver, muskrat, bald eagle, California gull, coyote, golden eagle, peregrine falcon, prairie falcon, skunk, weasel, and songbirds.

Rangeland habitat.—These areas are natural rangeland. Examples of birds and mammals generally common to these areas are chukar, sage grouse, songbirds, antelope, black-tailed jackrabbit, mule deer, woodchucks, bald eagle, blue grouse, bobcat, California quail, cottontail rabbit, coyote, desert bighorn sheep, golden eagle, gray partridge, ground squirrel, mourning dove, mule deer, peregrine falcon, prairie falcon, and weasel.

Food and cover for wildlife

The kind of habitat needed by wildlife depends on the species. Some live in woodland, some live in openland, and others live in rangeland. Ducks, geese, beaver, and muskrat require a watery habitat. Some wildlife eat insects and other animal foods, some eat only plant foods, and others eat a combination of the two.

Following is a brief summary of the food and cover needed by the kinds of wildlife species common in this survey area.

Antelope inhabit grassland, sagebrush range, grain fields, and hayfields. Grassland is used all seasons except winter. The greatest use for sagebrush range is in winter. Grain fields receive greatest use during fall and winter, and alfalfa fields are used extensively during the summer. Antelope are vegetarians and eat sagebrush, bitterbrush, saltbush, serviceberry, alfalfa, grain, sweetclover, Indian ricegrass, and winterfat. Antelope require water, which is commonly provided by livestock ponds and springs. They are found only in the western part of the survey area.

Bald eagles are occasionally seen in the survey area. They prefer to be secluded and away from man. They live on fish but also eat squirrels and other small animals.

Beavers live in streams, rivers, and ponds that provide an ample supply of food. Beavers are vegetarians and eat primarily bark or wood of twigs and branches of trees, such as aspen, cottonwood, and willow.

Black-tailed jackrabbits inhabit the open areas of the plains, deserts, and foothills. Jackrabbits are vegetarians and eat shrubs, grasses, forbs, and almost any available green plants.

Blue grouse eat mainly bearberry, bluegrass, clover, dandelion, elderberry, wild lettuce, currants, serviceberry, Douglas-fir nuts, oak, and snowberry. They live in the forested mountains during fall and winter and move to the lower elevations in the spring for nesting.

Bobcats are carnivorous and eat mainly rodents, birds, and rabbits. They will also eat young lambs. They range over a wide area, but are usually in the juniper or pinon areas in the winter and in the oak and aspen areas in the summer.

California gulls inhabit wet, marshy, open water areas. They are summer residents and nest in this area. They are scavengers.

Chukars inhabit areas having rocky slopes and steep areas with a grass-type food supply. They eat seeds and tender green leaves of both domestic and native plants. They also eat ants, beetles, crickets, and grasshoppers. They often congregate at water sites.

Cottontail rabbits are the most popular small game animal in the United States. They thrive on farm lands where cropland, grassland, and brushland are about equally represented and well distributed. Cottontails are vegetarians and thrive on grasses, clovers, small grain, bark of trees, and many kinds of shrubs. Brush piling is a good means of habitat improvement for these small creatures.

Coyotes are mainly carnivorous and feed on birds, lizards, rabbits, rodents, bird eggs, and occasionally lambs. They range throughout the survey area.

Desert bighorn sheep inhabit the mountain foot slopes and rugged mountain areas in the eastern part of the survey area. Their food is entirely of plant origin. It includes a large proportion of grasses, herbaceous plants, and some woody browse.

Ducks inhabit ponds, reservoirs, lakes, sloughs, and creeks. Water is essential for all kinds of ducks. Special

vegetative cover is necessary during seasons of nesting, rearing broods, and adult moult. Food consists of water-loving plants and aquatic insects. Ducks also feed extensively on domestic grains. They are migratory and respond to habitat development. The Bear River Migratory Bird Refuge, located about 17 miles west of Brigham City, is the largest of its kind in the world. Millions of migratory birds visit here each year for nesting and feeding.

Geese inhabit areas associated with water, either streams, lakes, reservoirs, or marshlands. They nest on islands in rivers or lakes and in trees or rocky hillsides. They prefer to feed on land rather than in water and eat primarily succulent green forage and grains, both native and domestic. Rarely do they eat animal foods. Geese are migratory and respond to habitat improvement.

Golden eagles are valuable birds of prey.

Gray partridge inhabit irrigated and nonirrigated cropland and grassy foothills. Brush cover is important for escape areas when snow covers the ground. These birds eat domestic grain and alfalfa and native plant seeds. Water is obtained from vegetation and insects, but the birds will use open water when available. They do not concentrate near waterholes.

Ground squirrels eat some insects but are primarily vegetarians. The two species of ground squirrels inhabiting the survey area are Townsend and Uinta.

Mourning doves inhabit open areas but are versatile in habitat needs. They are found mostly in irrigated valleys but are also common in nonirrigated areas. They nest in trees, in shrubs, or on the ground. They are primarily seed eaters and require water daily. These birds are migratory.

Mule deer eat a wide variety of shrubs, forbs, and grasses. They also eat acorns, fruits, tender parts of trees, and domestic crops. Deer drink frequently and may use snow for water. They also like salt. Woodland, brushy areas, rangeland, canyons, and mountains provide the necessary cover. Deer feed from early evening through the night and early morning.

Muskrat are semiaquatic and need water to live. They build dome-shaped lodges of vegetation and mud, high enough to keep their living rooms above water. The entrance to their house is below the waterline. They eat mostly leaves and roots of aquatic vegetation but will also forage for domestic crops.

Peregrine falcons are rare and endangered birds, also known as duck hawks. They inhabit rocky, ledgy, remote areas and live on small birds, muskrats, and small rodents. Peregrine falcons are fast-flying birds.

Porcupines are large rodents having sharp bristles or quills. They feed mostly on the bark of coniferous trees.

Prairie falcons inhabit rugged, rocky, ledgy areas but hunt in open areas. Their food is small rodents, mice, small birds, and even snakes.

Ring-necked pheasants inhabit the irrigated valleys. They use well-drained uplands and poorly drained areas for cover. Roadsides, weed patches, fence rows, ditchbanks, willow patches, grass and brush areas, hayfields, and grainfields are all used for cover and nesting. Pheasants eat weed seeds, grains, tender plants, fruits, berries, and insects. Water is important and may be taken from plants and insects or dew if open water is not available.

Sage grouse inhabit rangeland consisting of sagebrush, grasses, and forbs. Wet meadows in a sagebrush habitat are important. Sage grouse migrate to areas at higher or lower elevations, depending on the season. Strutting areas are also important. Sage grouse have a thin-walled stomach rather than a gizzard. Their food therefore consists of sagebrush leaves and leafy parts of native and domestic plants. They eat some insects but no seeds.

Shore birds feed primarily on aquatic animals, insects, fish, and crustaceans. Typical migrant birds that may be found at the wetland areas include the great blue heron, greater sandhill crane, common snipe, spotted sandpiper, swans, American avocet, and killdeer.

Skunks inhabit the valley and foothill areas. They feed on adult and larval insects, especially on grasshoppers, grubs, crickets, beetles, and wasps. Spiders are commonly eaten, and so are toads, frogs, lizards, mice, gophers, and bird eggs. Plant materials ordinarily constitute only a small part of the diet.

Songbirds usually find nesting sites in trees, fields, pastures, orchards, ponds, fence rows, streambank areas, and abandoned farmsteads. Blackbirds, finches, and sparrows eat mainly dry seeds, grains, grasses, and weeds. Robins, thrushes, bluebirds, and waxwings eat mainly berries, fruit, and insects. Swallows, nighthawks, and flycatchers eat flying insects caught on the wing. Woodpeckers, chickadees, and warblers eat insects, insect eggs, and larvae.

Weasels prey most commonly on rabbits, mice, squirrels, gophers, and other rodents, birds and their eggs, snakes, frogs, and fish. They are seldom if ever interested in plants as food. Weasels are voracious predators that are fairly common throughout the survey area, except at the higher elevations.

White pelicans are rare and endangered birds. They nest on small islands and beach areas and inhabit wetlands. They live mainly on fish.

Woodchucks (marmots) live in rocky, ledgy areas and are vegetarians.

Wildlife suitability groups

A wildlife suitability group consists of soils that have similar ratings for each of the habitat elements for all four kinds of wildlife habitat. The ratings for wildlife habitat are made on the basis of weighted factors assigned to a selection of habitat elements appropriate to the kind of wildlife habitat.

Each soil in this soil survey area has been rated for its suitability for improvement, maintenance, or creation of each of the habitat elements and each kind of wildlife habitat. The soils that had similar suitability for wildlife habitat were then grouped into 17 wildlife suitability groups.

In Utah, wildlife suitability groups are designated by a symbol representing the rating for a kind of wildlife habitat. The first positioned numeral is for openland habitat; the second is for woodland habitat; the third is for wetland habitat; and the fourth is for rangeland habitat. Number 1 is good; 2 is fair; 3 is poor; and 4 is very poor. For example, wildlife suitability group 3242 is poor for openland, fair for woodland, very poor for wetland, and fair for rangeland. Irrigated wildlife suitability groups have a capital letter I following the numeral symbol separated by a hyphen.

Knowing the properties of named kinds of soil makes it possible to predict how soils will behave under various vegetative and water management practices. Proper

handling of soils, water, and plants to produce a suitable habitat is the most effective way to maintain and improve wildlife populations.

Soils are rated on their suitability for growing plants or ponding water that produces a kind of wildlife habitat. Eight general plant groups or water development groups, called habitat elements, are used in rating the soils. These are grain and seed crops, domestic grasses and legumes, wild herbaceous plants, hardwood trees, coniferous trees, shrubs, wetland plants, and shallow water areas.

Soil suitability is expressed by adjective ratings of good, fair, poor, or very poor. A rating of good indicates that the soils have few or no limitations. Wildlife habitat is easily improved, maintained, or created. Fair indicates that the soils have moderate limitations. Habitat can be improved, maintained, or created, but limitations affect wildlife habitat development or management. Poor indicates that the soils have severe limitations. Wildlife habitat can be improved, maintained or created, but habitat management may be difficult and expensive and requires intensive effort. Very poor indicates that the soils are such that it is impractical to attempt to improve, maintain, or create wildlife habitat. Unsatisfactory results are probable.

Table 3 shows the adjective ratings for the habitat elements and kinds of groups.

WILDLIFE SUITABILITY GROUP 1121-I

This group consists of deep, somewhat poorly drained soils on alluvial fans, flood plains, and terraces. These soils are in the Airport, Draper, James Canyon, Lewiston, Martini, Sunset, Syracuse, and Warm Springs series. They have a surface layer of silt loam, loam, or fine sandy loam and underlying layers of loam to loamy sand. In places the soils contain gravel below a depth of 36 inches. Slopes range from 0 to 3 percent.

The average annual precipitation ranges from 12 to 17 inches, and the available water holding capacity is from 6.5 to 12 inches. Mean annual temperature ranges from 47° to 52° F., and the frost-free period is 125 to 160 days. In some places these soils are subject to flooding or overflow in spring. These soils are used for irrigated crops.

Important wildlife species are California quail, gray partridge, mourning dove, and ring-necked pheasant.

WILDLIFE SUITABILITY GROUP 1131-I

This group consists of deep, well drained to moderately well drained soils on broad lake terraces and alluvial fans. These soils are in the Fielding, Hansel, Kearns, Kidman, Millville, Parleys, Red Rock, and Timpanogos series. They have a surface layer of loam, silt loam, and light silty clay loam in some places. The subsoil is mainly silty clay loam or silt loam, but in places it is fine sandy loam to loamy fine sand below a depth of 48 inches. Slopes range from 0 to 40 percent.

The average annual precipitation ranges from 12 to 18 inches, and the available water holding capacity is from 7.5 to 12 inches. Mean annual temperature ranges from 47° to 51° F., and the frost-free period is 100 to 160 days. These soils are used mainly for irrigated crops. The vegetation in noncultivated areas is bluebunch wheatgrass, Great Basin wildrye, western wheatgrass, big sagebrush, and forbs.

Important wildlife species are black-tailed jackrabbit, California quail, cottontails, gray partridge, mourning dove, porcupines, and ring-necked pheasant.

WILDLIFE SUITABILITY GROUP 1141-I

This group consists of deep, well-drained to somewhat excessively drained soils on terraces, alluvial fans, and foot slopes. These soils are in the Dagor, Francis, Kilburn, and Timpanogos series. They have a surface layer and underlying layers of loam or loamy fine sand. The Kilburn soils included with this group are gravelly loam to sandy loam throughout. Slopes range from 1 to 20 percent but most commonly are 3 to 6 percent.

The average annual precipitation ranges from 14 to 18 inches. Available water holding capacity is generally 10 to 12 inches, but for the Francis and Kilburn soils it is

TABLE 3.—*Wildlife suitability groups and ratings*

Wildlife suitability group	Potential for habitat elements				
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous trees
1121–I	Good	Good	Good	Good	
1131–I	Good	Good	Good	Good	
1141–I	Fair	Good	Good	Good	
1141	Fair	Good	Good		Good
2122–I	Fair	Fair	Fair	Good	
2141	Fair	Fair	Good		Good
2232–I	Fair	Fair	Fair	Fair	
2232	Poor	Fair	Fair	Fair	
2242	Poor	Fair	Fair	Fair	Fair
3141	Very poor	Very poor	Good	Good	
3232	Very poor	Very poor	Fair	Poor	
3242	Very poor	Very poor	Fair		Fair
3323–I	Poor	Poor	Poor	Very poor	
4343	Very poor	Very poor	Poor		Poor
4424–I	Very poor	Very poor	Very poor	Very poor	
4434	Very poor	Very poor	Very poor		Very poor
4444	Very poor	Very poor	Very poor	Very poor	Very poor

4 to 5 inches. Mean annual temperature ranges from 48° to 51° F., and the frost-free period is 140 to 160 days. These soils are used mainly for irrigated crops and orchards. The vegetation in noncultivated areas is Indian ricegrass, sand dropseed, bluebunch wheatgrass, western wheatgrass, and some shrubs and forbs.

Important wildlife species are mourning dove, ring-necked pheasant, skunks, songbirds, sage grouse, and woodchuck.

WILDLIFE SUITABILITY GROUP 1141

This group consists of deep, well-drained soils on alluvial fans and terraces. These soils are in the Hendricks, Mendon, and Red Rock series. They have a surface layer of silt loam and a subsoil of silty clay loam, loam, and silt loam. Slopes range from 0 to 10 percent but most commonly are 0 to 6 percent.

The average annual precipitation ranges from 14 to 18 inches, and the water-supplying capacity is 14 to 16 inches. Mean annual temperature ranges from 45° to 50° F., and the frost-free period is 100 to 140 days. These soils are used mainly for nonirrigated crops. The vegetation in noncultivated areas is bluebunch wheatgrass, slender wheatgrass, sagebrush, yellowbrush, and forbs.

Important wildlife species are California quail, chukar, cottontails, ground squirrels, mourning dove, and ring-necked pheasant.

WILDLIFE SUITABILITY GROUP 2122-I

This group consists of deep, moderately well drained to poorly drained soils on low lake terraces and lake plains. These soils are in the Collett, Cudahy, Greenson, Honeyville, Logan, Roshe Springs, Syracuse, and Woods Cross series and the Peteetneet variant. Generally, these soils are silty clay loam throughout, but some areas are silt loam to fine sandy loam. Included in this group is the Peteetneet variant, which has 24 to 36 inches of peat over silty clay loam, and Cudahy soils which are 20 to 40 inches deep over a hardpan of indurated lime. Slopes range from 0 to 3 percent.

Average annual precipitation ranges from 12 to 17 inches. The available water holding capacity is 10 to 12 inches, except in the Cudahy and Syracuse soils, where it is 5 to 8.5 inches. Mean annual temperature ranges from 47° to 51° F., and the frost-free period is 130 to 155 days. Where areas of these soils are drained, they are used mainly for irrigated crops and some native meadows. The vegetation in noncultivated areas is wiregrass, sedges, Kentucky bluegrass, and saltgrass. The water table fluctuates with the season, but where these soils are not drained, it is mainly at a depth of 20 to 40 inches.

Important wildlife species are ducks, geese, muskrat, ring-necked pheasant, shore birds, and songbirds.

WILDLIFE SUITABILITY GROUP 2141

This group consists of deep, well-drained soils on lake terraces, alluvial fans, and mountain foot slopes. These soils are in the Anty, Collinston, Forsgren, Gemson, Goring, Hendricks, Kearns, Kidman, Manila, Parleys, Red Rock, and Timpanogos series and the Goring and Kearns variants. Generally, they have a surface layer of silt loam, loam, or clay loam and a subsoil of clay, silty clay, or clay loam. In some areas of these soils, the surface layer and underlying layers are silt loam or fine sandy loam. In some places, gravel or cobblestones are below a depth of 48 inches. Slopes range from 0 to 30 percent but most commonly are 0 to 10 percent.

The average annual precipitation ranges from 14 to 26 inches, and the water-supplying capacity is 10 to 18 inches. Mean annual temperature ranges from 42° to 52° F., and the frost-free period is 75 to 140 days. These soils are used mainly for nonirrigated crops. The vegetation in noncultivated areas is bluebunch wheatgrass, Great Basin wildrye, Indian ricegrass, bearded wheatgrass, sagebrush, yellowbrush, serviceberry, and other shrubs and forbs.

Important wildlife species are black-tailed jackrabbit, blue grouse, California quail, chukar, mourning dove, ring-necked pheasant, and songbirds.

for habitat elements and kinds of habitat

Potential for habitat elements—Continued			Potential for kinds of habitat			
Shrubs	Wetland plants	Shallow water areas	Openland	Woodland	Wetland	Rangeland
Good	Fair	Fair	Good	Good	Fair	Good.
Good	Poor	Fair	Good	Good	Poor	Good.
Good	Very poor	Very poor	Good	Good	Very poor	Good.
Good	Very poor	Very poor	Good	Good	Very poor	Good.
Fair	Fair	Fair	Fair	Good	Fair	Fair.
Good	Very poor	Very poor	Fair	Good	Very poor	Good.
Fair	Poor	Poor	Fair	Fair	Poor	Fair.
Fair	Poor	Poor	Fair	Fair	Poor	Fair.
Fair	Very poor	Very poor	Fair	Fair	Very poor	Fair.
Good	Very poor	Very poor	Poor	Good	Very poor	Good.
Fair	Very poor	Fair	Poor	Fair	Poor	Fair.
Fair	Very poor	Very poor	Poor	Fair	Very poor	Fair.
Poor	Fair	Fair	Poor	Poor	Fair	Poor.
Poor	Very poor	Very poor	Very poor	Poor	Very poor	Poor.
Very poor	Poor	Good	Very poor	Very poor	Fair	Very poor.
Very poor	Poor	Poor	Very poor	Very poor	Poor	Very poor.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.

WILDLIFE SUITABILITY GROUP 2232-I

This group consists of deep, well-drained soils that are on lake terraces only in an area west of Snowville. These soils are in the Palisade and Thiokol series. The surface layer and underlying layers are mainly silt loam or loam, but they include some very fine sandy loam below a depth of 36 inches. Slopes range from 0 to 6 percent but most commonly are 0 to 2 percent.

The average annual precipitation ranges from 8 to 11 inches, and the available water holding capacity is from 8 to 12 inches. Mean annual air temperature ranges from 45° to 52° F., and the frost-free period is 85 to 100 days. Where the soils are irrigated, water is obtained entirely by pumping from wells. The vegetation in noncultivated areas consists of squirreltail, winterfat, bluebunch wheatgrass, annual mustard, sagebrush, and forbs.

Important wildlife species are antelope, black-tailed jackrabbit, coyote, and ring-necked pheasant.

WILDLIFE SUITABILITY GROUP 2232

This group consists of deep, well-drained soils on lake terraces and alluvial fans. These soils are in the Eccles, Hansel, Kidman, Kearns, Parleys, Red Rock, and Thiokol series. They have a surface layer of silt loam, loam, and fine sandy loam and underlying layers of silty clay loam, silt loam, loam, and fine sandy loam. Slopes range from 0 to 3 percent but most commonly are 0 to 1 percent.

The average annual precipitation ranges from 11 to 17 inches, and the water-supplying capacity is 8 to 13 inches. Mean annual temperatures ranges from 46° to 53° F., and the frost-free period is 100 to 140 days. These soils are used mainly for nonirrigated crops. The vegetation in the noncultivated areas is Great Basin wildrye, bluebunch wheatgrass, western wheatgrass, Indian ricegrass, sagebrush, yellowbrush, and forbs.

Important wildlife species are antelope, black-tailed jackrabbit, California quail, mourning dove, ring-necked pheasant, and sage grouse.

WILDLIFE SUITABILITY GROUP 2242

This group consists of deep, well-drained soils on alluvial fans, offshore bars, and lake terraces. These soils are in the Eccles, Hansel, Pomat, Stingal, Thiokol, and Windmill series. They have a surface layer of silt loam, loam, and fine sandy loam and underlying layers of silty clay loam and fine sandy loam. Slopes range from 1 to 30 percent but most commonly are 1 to 10 percent.

The average annual precipitation ranges from 11 to 14 inches, and the water-supplying capacity is 8 to 11 inches. Mean annual temperature ranges from 46° to 50° F., and the frost-free period is 100 to 140 days. These soils are used mainly for nonirrigated crops. Extensive areas of these soils have been seeded to crested wheatgrass. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Sandberg bluegrass, sand dropseed, sagebrush, yellowbrush, forbs, and juniper in some places.

Important wildlife species are black-tailed jackrabbit, California quail, cottontails, gray partridge, ring-necked pheasant, and sage grouse.

WILDLIFE SUITABILITY GROUP 3141

This group consists of mainly deep and well-drained soils, but in some of the soils bedrock is at a depth of 20 to 40 inches. The soils in this wildlife group are in the Bickmore, Broad, Elzinga, Lucky Star, Manila, Maughan, Obray, Picayune, Smarts, and Yeates Hollow series. These soils are dominantly on north- and east-facing mountain slopes. They have a surface layer of silt loam or loam and gravelly, cobbly, or stony clay loam and loam. The underlying layers are very gravelly loam, very cobbly clay loam, and loam. Included are soils that have a surface layer and, underlying layers of clay. Slopes range from 10 to 70 percent but most commonly are 25 to 60 percent.

The average annual precipitation ranges from 16 to 28 inches. The water-supplying capacity is 9 to 21 inches, except in the Broad soils, where it is 6.5 to 8 inches. Mean annual temperature ranges from 38° to 45° F., and the frost-free period is 70 to 100 days. Generally, the native vegetation is maple, oakbrush, aspen, snowberry, chokecherry, serviceberry, sagebrush, yellowbrush, bluebunch wheatgrass, mountain brome, and other grasses and forbs. Vegetation on the Bickmore soils is mainly Douglas-fir and alpine fir.

Important wildlife species are bobcat, cottontails, desert bighorn sheep, ground squirrels, mule deer, songbirds, woodchuck, and some bald eagles.

WILDLIFE SUITABILITY GROUP 3232

The only soil in this group is Thiokol silt loam, low rainfall, 0 to 1 percent slopes. It is a deep, well-drained soil and is on broad, nearly level lake terraces in an area southwest of the town of Snowville. This soil has underlying layers of silt loam or loam.

The average annual precipitation ranges from 8 to 11 inches, and the water-supplying capacity is 6 to 8 inches. Mean annual temperature ranges from 45° to 46° F., and the frost-free period is 85 to 100 days. This soil is used for range. The native vegetation is mainly sagebrush but includes squirreltail, winterfat, dwarf rabbitbrush, and forbs.

Important wildlife species are antelope, black-tailed jackrabbit, coyote, and sage grouse.

WILDLIFE SUITABILITY GROUP 3242

This group consists of deep, well-drained to excessively drained soils on lake terraces, alluvial fans, terrace escarpments, mountain foot slopes, and mountains. These soils are in the Abela, Bingham, Blue Star, DeJarnet, Hupp, Kapod, Kilburn, Middle, Munk, Pomat, Sandall, Sanpete, Sheeprock, Sterling, Thiokol, Wasatch, and Wheelon series; the Blue Star series, gravelly subsoil variant; and the Eccles series, sandy variant. Nearly all the soils are deep, but the Sandall soils are underlain by bedrock at a depth of 20 to 40 inches. Generally, soils in this group have a surface layer of gravelly, cobbly, or stony silt loam or loam and underlying layers of very gravelly or cobbly clay loam to loamy sand. Some of the soils, however, have a surface layer and underlying layers of silt loam or loam. Slopes range from 1 to 70 percent but mainly are 1 to 20 percent.

Average annual precipitation generally ranges from 11 to 18 inches, though in areas of Thiokol soils it ranges from 8 to 11 inches. Water-supplying capacity is mainly 7 to 11 inches, but in some of the soils it is as low as 4 to 6 inches. Mean annual air temperature ranges from 45° to 52° F. The frost-free period generally is 100 to 150 days,

but for the Thiokol soils the period is 85 to 100 days. Vegetation consists mainly of bluebunch wheatgrass, Great Basin wildrye, sand dropseed, sagebrush, yellowbrush, bitterbrush, and forbs. Vegetation on the Sandall soils is dominantly juniper.

Important wildlife species are black-tailed jackrabbit, chukar, cottontails, mourning dove, and songbirds.

WILDLIFE SUITABILITY GROUP 3323-I

This group consists of deep, moderately well drained to poorly drained soils on low lake terraces, alluvial fans, and flood plains. These soils are in the Airport, Bram, Fridlo, Greenson, Kirkman, Lasil, Magna, and Stokes series. The surface layer is silt loam, loam, or silty clay loam, and the underlying layers are mainly silty clay loam or silty clay and some loam or silt loam. Slopes are 0 to 2 percent.

The average annual precipitation ranges from 11 to 16 inches. Mean annual temperature ranges from 46° to 52° F., and the frost-free period is 100 to 150 days. These soils are slightly to moderately affected by salts and moderately to strongly affected by alkali. The water-holding capacity is 9 to 12 inches, but the water available to plants is reduced because of the salt content. Depth to the water table ranges from 18 to 48 inches where the soils are not drained. Some areas have been leveled, drained, and reclaimed and are used for irrigated crops and irrigated pasture. The vegetation in noncultivated areas is greasewood, shadscale, alkali sacaton, saltgrass, Great Basin wildrye, annual mustard, and forbs.

Important wildlife species are black-tailed jackrabbit, California quail, mourning dove, muskrat, ring-necked pheasant, California gull, and songbirds.

WILDLIFE SUITABILITY GROUP 4343

This group consists of well-drained to excessively drained soils that are mainly on south- and west-facing mountain slopes, terrace escarpments, and mountain foot slopes. These soils are in the Agassiz, Etil, Foxol, Pass Canyon, Promo, Richmond, Wasatch, and Wheelon series; the Wasatch and Wheelon variants; and Rough broken land, Stony alluvial land, and Very stony land. These soils are shallow with bedrock at a depth of less than 20 inches, extremely stony, very droughty, or very steep. They are cobbly, gravelly, or stony and have textures that range from clay to sandy loam. Included in this group are the Etil soils that are loamy sand to fine sand throughout and are on low terraces. Slopes range from 1 to 70 percent.

The average annual precipitation ranges from 8 to 26 inches. Mean annual temperature ranges from 40° to 52° F. The native vegetation is mainly oakbrush, maple, and juniper but includes bluebunch wheatgrass, Great Basin wildrye, squirreltail, sand dropseed, sagebrush, and yellowbrush.

Important wildlife species are desert bighorn sheep, ground squirrels, mourning dove, mule deer, and woodchuck.

WILDLIFE SUITABILITY GROUP 4424-I

This group consists of poorly drained to somewhat poorly drained soils on flood plains, low lake terraces, and lake plains. These soils are in the Airport, Arave, Gooch, Lasil, Lakeshore, Logan, Payson, Placeritos, Pogal, Refuge, Saltair, and Woods Cross series. Slopes most commonly are less than 1 percent. The surface layer and underlying layers are silty clay loam and sandy loam. Also included are Fresh water marsh and Playas. Fresh water marsh is in natural depressions and ponds and is covered by water most of the year. Playas are nearly barren and very salty and are on lake plains bordering the Great Salt Lake.

The average annual precipitation ranges from 11 to 16 inches. Mean annual temperature ranges from 46° to 52° F., and the frost-free period is 100 to 150 days. Soils in this group are moderately to very strongly affected by salts and alkali. Their water-holding capacity is 9 to 12 inches, but the water available to plants is only about 3 to 8 inches because of the high salt content. Depth to the water table generally ranges from 20 to 30 inches in areas where the soils are not drained, but in some places the water table is at or near the surface for most of the year. The native vegetation generally is saltgrass, alkali sacaton, greasewood, foxtail, and forbs. Some areas are nearly barren or have only a sparse cover of pickleweed.

Important wildlife species are beaver, white pelican, California gull, ducks, geese, shore birds, and songbirds.

WILDLIFE SUITABILITY GROUP 4434

This group consists of deep, well-drained soils on low lake plains and lake terraces. These soils are in the Bram, Drum, Harding, Mellor, Palisade, and Uffens series. The surface layer is silt loam, and the underlying layers are silty clay, silty clay loam, or very fine sandy loam. Slopes range from 0 to 10 percent but most commonly are 0 to 2 percent.

The average annual precipitation ranges from 6 to 11 inches, and the water-supplying capacity is 4 to 8 inches. Mean annual temperature ranges from 47° to 52° F., and the frost-free period is 90 to 130 days. The soils in this group are moderately to strongly affected by salts and alkali. These soils are used for range. Vegetation is greasewood, shadscale, rubber rabbitbrush, pickleweed, squirreltail, winterfat, annual mustard, some sagebrush, and forbs.

Important wildlife species are antelope, black-tailed jackrabbit, ground squirrels, cottontails, and shore birds.

WILDLIFE SUITABILITY GROUP 4444

This group consists of Borrow pits, Gravel pits, Gullied land, Rock land, and Rock outcrop. These land types are either very shallow soils, or occur on very steep slopes or on escarpments, or are subject to very active erosion. Some areas are exposures of bare bedrock. The bottoms of Gravel and Borrow pits are nearly level, but slopes range from 3 to 25 percent in Gullied land and are more than 70 percent or are nearly sheer cliffs in areas of Rock outcrop.

Vegetation varies widely with each land type. Annual weeds and willows commonly grow in Borrow pits and Gravel pits. Sagebrush, sweetclover, and some grasses are found in Gullied land. Rock land supports scattered shrubs and some grasses, but Rock outcrop is barren.

These areas support little wildlife, but wildlife species that may be found are bald eagle, ring-necked pheasant, and songbirds.

Engineering Uses of the Soils [5]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to predict performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4, 5, and 6. Table 4 shows estimated soil properties significant in engineering. Table 5 gives interpretations for various engineering uses. Table 6 lists results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 5, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary at the back of this survey defines many of these terms commonly used in soil science.

[5] WILLIAM D. GODDARD, engineer, Soil Conservation Service, assisted in preparing this section.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified soil classification system, developed by Dr. Arthur Casagrande of Harvard University for the Corps of Engineers during World War II, and the AASHO classification system, adopted by the American Association of State Highway Officials.

In the Unified system (*6, 14*) soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. This system is used by the U.S. Corps of Engineers, the U.S. Bureau of Reclamation, and the Soil Conservation Service.

The AASHO system (*1*) is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 6; the estimated classification, without group index numbers, is given in table 4 for all soils mapped in the survey area.

Estimated soil properties significant in engineering

Table 4 gives estimates of soil properties that are significant in engineering. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kind of soil in other counties.

The meaning of hydrologic groups shown in table 4 may not be familiar to some persons who use this survey. These data are used in estimating the total volume and peak runoff that can be expected from storms of a given amount and intensity. The data are useful in planning measures to control water. In group A are coarse textured and moderately coarse textured soils that transmit water through their profile at a rapid rate. These soils absorb the precipitation that falls in most storms, and they have the highest rate of infiltration, even when they are thoroughly wet, and the lowest runoff potential.

In group B are the moderately coarse textured to moderately fine textured, deep or very deep soils that transmit water through their profile at a moderate rate. These soils have a moderate runoff potential.

In group C are the moderately coarse textured to fine-textured, deep to shallow soils that transmit water through their profile at a slow rate. These soils have a high runoff potential.

In group D are the medium-textured, moderately fine textured, and fine textured soils. Some soils in this group have a high water table, some have a thin mantle of soil over impervious material, some have a surface layer consisting of impervious material, and some are very deep. Soils in group D have the highest runoff potential of any soils in the survey area.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Soil texture is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added; for example, "gravelly loamy sand". "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary at the back of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 4 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The colorimetric method was used to determine the pH values.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Interpretations of engineering properties

The estimated interpretations in table 5 are based on the engineering properties of soils shown in table 4, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Box Elder County. In table 5, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for pond reservoi-areas; embankments, dikes, and levees; drainage of cropland and pasture; irrigation; and terraces and diversions. For these particular uses, table 5 lists soil features that should not be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use, or in other words, that limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special designs.

Soil suitability is rated by the terms *good, fair,* and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 5.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material at a depth between 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs. Ratings are based on a tile depth of 2 feet. If the septic tank is from a basement, the rating should be one class lower if a high water table or a restrictive layer is present.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material (*4*). The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope, and, if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification system and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Local roads and streets, as rated in table 5, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soils. The soils in referring to other series that appear in the first column of this

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification USDA texture	Classification Unified
		Inches	*Inches*	*Inches*		
Abela: ABE, AEE	B	60+	60+	0–28	Gravelly loam	SC, SM, or GM
				28–60	Very gravelly loam	GM or GC
*Agassiz: AGG. For Picayune part, see Picayune series.	D	60+	14–19	0–19	Cobbly or very cobbly loam.	GM or ML
				19	Fractured limestone.	
Airport:						
Ao, Ap	D	26–40 (undrained)	60+	0–60	Stratified silt loam, silty clay loam, and fine sandy loam.	ML or CL
Ar	D	40–60 (drained)	60+	0–60	Stratified silt loam and silty clay loam.	ML or CL
Anty: AtB, AtD	B	60+	60+	0–26	Fine sandy loam	ML or SM
				26–62	Sandy loam to loamy fine sand.	SM
Arave: AV	D	12–30	60+	0–60	Silty clay loam	CL
Bickmore: BCG	C	60+	36–40	0–10	Loam	SM
				10–22	Gravelly silty clay loam.	GM, GC, ML, or CL
				22–39	Very gravelly loam	GM or GP–GM
				39	Fractured limestone.	
Bingham: BdB, BeB, BeD	B	60+	60+	0–7	Gravelly loam	ML or GM
				7–21	Gravelly clay loam	GM or ML
				21–31	Very gravelly loam	GM or GP–GM
				31–60	Very gravelly loamy sand	GP–GM
Blue Star: BgE, BLG	B	60+	60+	0–10	Gravelly loam	GM or SM
				10–37	Gravelly sandy loam	GM
				37–60	Gravelly sand	GP–GM or GM
Blue Star, gravelly subsoil variant: BhD	B	60+	60+	0–19	Gravelly loam	GM or SM
				19–60	Very gravelly loamy sand	GP or GP–GM
Borrow pits: Bp. Too variable to estimate.						
Bram: BR	B	[2] 60+	60+	0–5	Silt loam	ML
				5–64	Silt loam	ML
*Broad: BSE, BSG, BTG, BUG, BVG. For Manila part of BTG, Middle part of BUG, and Smarts part of BVG, see their respective series.	C	60+	30–40	0–9	Cobbly loam	ML or CL
				9–22	Gravelly clay loam	CL
				22–36	Very gravelly clay loam	GC
				36	Fractured sandstone.	
Collett: Co	C	30–40 (undrained)	60+	0–14	Silty clay loam	CL
		40–60 (drained)		14–23	Silty clay	CL
				23–66	Silty clay loam	CL
*Collinston: CwD. For Wheelon part, see Wheelon series.	C	60+	60+	0–72	Silt loam	ML

See footnotes at end of table.

significant in engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for table. The sign > means more than; the sign < means less than]

Classification—Con. AASHO	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A–1, A–2, or A–4	0–10	40–85	30–70	25–65	15–50	2.0–6.0	0.06–0.09	7.9–9.0	None to low	Low.
A–1	10–70	40–60	30–50	25–45	15–25	2.0–6.0	0.06–0.09	8.5–9.0+	None	Low.
A–4	30–60	65–85	60–80	55–75	40–60	0.6–2.0	0.10–0.16	7.4–8.4	None	Low.
A–4 or A–6	----------	--------	100	95–100	75–95	0.06–0.2	0.17–0.20	7.9–9.0+	Low to moderate.	Moderate.
A–4 or A–6	----------	--------	100	95–100	75–95	0.06–0.2	[1] 0.11–0.15	9.0+	High	Moderate.
A–4	----------	--------	100	70–95	40–60	2.0–6.0	0.13–0.16	7.4–9.0	None	Low.
A–4	----------	--------	100	70–95	35–50	2.0–6.0	0.11–0.14	8.5–9.0	None	Low.
A–6 or A–7	----------	--------	100	90–100	80–85	0.2–0.6	[1] 0.05–0.13	7.9–9.0+	Moderate to high.	Moderate.
A–4	0–10	85–100	70–90	65–85	40–50	0.6–2.0	0.11–0.15	6.6–7.3	None	Low.
A–4 or A–6	20–30	70–90	50–75	45–70	40–60	0.6–2.0	0.11–0.15	6.6–7.3	None	Low.
A–1	35–50	30–50	20–40	15–40	10–25	2.0–6.0	0.08–0.10	6.6–7.8	None	Low.
A–4	0–15	65–90	60–90	45–70	40–65	2.0–6.0	0.12–0.14	7.4–8.4	None	Low.
A–4 or A–6	0–15	50–80	45–70	40–70	35–60	2.0–6.0	0.09–0.10	7.4–8.4	None	Moderate.
A–1	15–45	40–50	20–40	20–35	10–25	2.0–6.0	0.05–0.07	8.5–9.0	None	Low.
A–1	15–45	30–50	20–40	15–25	5–10	>6.0	0.05–0.07	8.5–9.0	None	Low.
A–2 or A–4	----------	60–90	50–70	45–60	30–50	2.0–6.0	0.12–0.16	7.9–8.4	None	Low.
A–1 or A–2	----------	60–90	50–70	30–60	15–20	>6.0	0.07–0.10	7.9–9.0	None	Low.
A–1 or A–2	----------	50–80	35–70	30–50	5–25	>6.0	0.06–0.09	7.9–9.0	None	Low.
A–2 or A–4	----------	60–90	55–85	45–75	30–50	2.0–6.0	0.12–0.16	7.4–8.4	None	Low.
A–1	----------	50–80	20–45	15–40	0–10	>6.0	0.03–0.06	7.9–9.0	None	Low.
A–4	----------	--------	100	95–100	75–95	0.6–2.0	0.15–0.20	7.9–9.0+	None to low	Low.
A–4	----------	--------	100	95–100	75–95	0.2–0.6	[1,2] 0.05–0.20	8.5–9.0+	Low to high	Low.
A–4 or A–6	5–30	70–95	65–90	60–80	50–60	0.6–2.0	0.12–0.15	6.6–7.8	None	Low.
A–6 or A–7	30–40	65–75	60–70	55–65	50–60	0.6–2.0	0.12–0.15	7.4–8.4	None	Moderate.
A–2	35–75	40–60	30–50	25–40	20–35	0.6–2.0	0.09–0.12	7.9–9.0	None	Low.
A–6 or A–7	----------	--------	100	95–100	85–100	0.06–0.2	0.17–0.19	7.9–9.0	None	High.
A–7	----------	--------	100	95–100	90–100	0.06–0.2	0.18–0.20	7.9–9.0	None	High.
A–6 or A–7	----------	--------	100	95–100	85–100	0.20–0.6	0.17–0.19	8.5–9.0+	None	High.
A–4	----------	--------	100	95–100	75–90	0.6–2.0	0.17–0.20	7.4–9.0+	None	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified
		Inches	*Inches*	*Inches*		
Cudahy: Cy	D	20–30	[3] 23–40	0–29	Silt loam	ML
				29–44	Lime-cemented hardpan	
				44–60	Silty clay loam	CL
Dagor: DaB	B	60+	60+	0–60	Loam	ML
DeJarnet: DgB, DgD	B	60+	60+	0–10	Gravelly silt loam	ML or GM
				10–60	Very gravelly loam	GM or GP–GM
Draper: DrA	C	30–42	60+	0–60	Loam	ML or CL
Drum: DU	C	60+	60+	0–36	Silt loam	ML
				36–60	Silty clay loam	CL
Eccles: EcA, EcB, EcD	B	60+	60+	0–62	Fine sandy loam	SM or ML
Eccles, sandy variant: ElB	B	60+	60+	0–64	Loamy sand and sandy loam.	SM
*Elzinga: EMF, ENF. For Agassiz part of EMF and Maughan part of ENF, see Agassiz and Maughan series.	B	60+	60+	0–24	Silt loam	ML
				24–53	Very gravelly silt loam	GM
				53–64	Gravelly clay loam	GC or CL
Etil: ETB	A	24–60+	60+	0–5	Loamy sand	SM
				5–60	Sand	SP–SM or SM
Fielding: Fd, Fe	B	45–60+	60+	0–66	Silt loam or silty clay loam.	ML or CL
Forsgren: FgB, FgD, FgE	C	60+	60+	0–8	Silt loam	CL or ML
				8–52	Silty clay or silty clay loam.	CL
				52–66	Silt loam	CL or ML
*Foxol: FHG, FRG. For Elzinga part of FHG, see Elzinga series. Rock outcrop part of FRG is too variable to estimate.	D	60+	14–20	0–13	Gravelly loam	GM
				13–17	Very gravelly loam	GM or GP–GM
				17	Fractured quartzite.	
Francis: FsB	A	60+	60+	0–60	Loamy fine sand	SM
Fresh water marsh: FT. Too variable to estimate.						
Fridlo:						
Fu	C	50+	60+	0–29	Silt loam or silty clay loam.	CL or ML
				29–60	Silty clay loam	CL
Fv	C	30–50 (undrained) 50+ (drained)	60+	0–60	Silt loam or silty clay loam.	CL or ML
Gemson: GcD, GcE, GEE. Rock land part of GEE is too variable to estimate.	C	60+	60+	0–74	Silty clay loam or silty clay.	CL

See footnotes at end of table.

significant in engineering—Continued

Classification—Con. AASHO	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A-4			100	95–100	75–90	0. 6–2. 0	0. 16–0. 19	7. 9–8. 4	None to low	Low.
						<0. 06		7. 9–8. 4	None.	
A-6			100	95–100	80–95	0. 6–2. 0		7. 9–8. 4	None	Moderate.
A-4		90–100	85–100	75–95	50–60	0. 6–2. 0	0. 17–0. 19	7. 4–8. 4	None	Low.
A-4	0–10	55–70	50–70	45–65	40–60	0. 6–2. 0	0. 12–0. 15	6. 6–8. 4	None	Low.
A-1 or A-2	10–25	25–55	20–45	30–40	10–30	0. 6–2. 0	0. 07–0. 11	6. 6–9. 0	None	Low.
A-4 or A-6			85–100	80–100	50–70	0. 6–2. 0	0. 15–0. 18	7. 9–8. 4	None	Moderate.
A-4			100	95–100	75–95	0. 6–2. 0	[1] 0. 07–0. 11	8. 5–9. 0+	Moderate to very high.	Low to moderate.
A-6			100	95–100	80–95	0. 2–0. 6	[1] 0. 03–0. 11	8. 5–9. 0+	Moderate to very high.	Moderate.
A-4			95–100	70–85	40–55	2. 0–6. 0	0. 12–0. 15	7. 9–9. 0+	None to low	Low.
A-2 or A-4			95–100	65–90	30–45	>6. 0	0. 08–0. 10	7. 9–9. 0+	None	Low.
A-4		100	70–90	65–85	50–70	0. 6–2. 0	0. 15–0. 18	5. 6–6. 5	None	Low.
A-2	30–45	40–50	30–40	30–40	25–35	0. 6–2. 0	0. 09–0. 12	5. 6–6. 5	None	Low.
A-6 or A-7	25–65	55–70	50–65	45–60	35–55	0. 6–2. 0	0. 11–0. 14	5. 6–6. 5	None	Low.
A-2			90–100	50–80	15–30	>6. 0	0. 06–0. 09	7. 9–9. 0	Low to moderate.	Low.
A-2 or A-3			90–100	50–75	5–15	>6. 0	0. 06–0. 09	7. 9–9. 0+	Low to moderate.	Low.
A-4, A-6, or A-7			100	95–100	75–95	0. 6–2. 0	0. 17–0. 20	7. 4–9. 0+	None	Low to moderate.
A-4 or A-6			100	90–100	75–95	0. 6–2. 0	0. 17–0. 20	6. 6–7. 8	None	Moderate.
A-7			100	95–100	85–95	0. 06–0. 2	0. 17–0. 20	6. 6–8. 4	None	High.
A-4 or A-6			100	90–100	75–95	0. 06–0. 2	0. 17–0. 20	7. 9–9. 0	None	Moderate.
A-2	0–25	50–70	40–65	55–60	25–35	0. 6–2. 0	0. 08–0. 11	6. 1–6. 5	None	Low.
A-1 or A-2	40–85	25–60	15–50	15–45	10–30	0. 6–2. 0	0. 07–0. 10	6. 1–6. 5	None	Low.
A-2			100	50–75	15–35	>6. 0	0. 06–0. 09	6. 6–7. 8	None	Low.
A-4 or A-6			100	95–100	80–100	0. 06–0. 2	[1] 0. 13–0. 16	7. 9–9. 0+	Low to moderate.	Moderate.
A-6			100	95–100	80–100	0. 06–0. 2	[1] 0. 06–0. 10	8. 5–9. 0+	Moderate to high.	Moderate.
A-4 or A-6			100	85–100	80–100	0. 2–0. 6	0. 15–0. 18	7. 9–9. 0+	Low	Moderate.
A-7	0–5	90–100	90–100	85–100	80–95	0. 06–0. 2	0. 17–0. 20	6. 6–9. 0+	None	Moderate to high.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified
		Inches	*Inches*	*Inches*		
Gooch: Gh	D	<20	60+	0–30	Silt loam	ML
				30–65	Silty clay loam	ML or CL
*Goring: GLE. For Yeates Hollow part, see Yeates Hollow series.	C	60+	60+	0–18	Clay loam	ML or CL
				18–48	Clay	CL or CH
				48–60	Gravelly clay	CL
Goring, brown subsoil variant: GM	C	60+	60+	0–22	Loam	ML
				22–54	Silty clay	CL or CH
				54–68	Clay loam	CL
Gravel pits: Gp. Too variable to estimate.						
Greenson:						
Gr	C	30–48 (undrained)	60+	0–39	Silt loam	ML
				39–64	Stratified silty clay and fine sandy loam.	CL or ML
Gs	C	48+ (drained)	60+	0–34	Silt loam	ML or CL
				34–66	Silty clay	CL or ML
Gullied land: GU. Too variable to estimate.						
Hansel: HaA, HaB, HaD	C	60+	60+	0–62	Silt loam or silty clay loam.	CL or ML
Harding: HD	D	60+	60+	0–5	Silt loam	ML
				5–19	Silty clay	CL or CH
				19–64	Silt loam	ML
*Hendricks: HeB, HeD, HeE, HkD. For Kearns part of HkD, see Kearns series.	B	60+	60+	0–11	Silt loam	ML
				11–67	Silty clay loam	CL
Honeyville: Ho	C	30–44 (undrained) 44–60 (drained)	60+	0–64	Silty clay loam	CL
Hupp: HpB, HpD, HuC, HuD	B	60+	60+	0–18	Gravelly silt loam	GM or ML
				18–60	Very gravelly silt loam	GM or ML
James Canyon: JaA	B	30–36 (undrained) 40+ (drained)	50+	0–35	Loam	ML
				35–60	Gravelly loam and gravelly sandy loam.	GM
Kapod: KaE	B	60+	60+	0–13	Stony loam	GM
				13–65	Very cobbly sandy clay loam or very gravelly loam.	GM or GC
*Kearns: KeB, KeC, KeD, KeE, KgD. For Stingal part of KgD, see Stingal series.	B	60+	60+	0–76	Silt loam and loam	ML or CL

See footnotes at end of table.

significant in engineering—Continued

Classification—Con. AASHO	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A–4			100	90–100	70–85	0.2–0.6	[1] 0.10–0.13	8.5–9.0+	Moderate to high.	Moderate.
A–4 or A–6			100	95–100	70–85	0.06–0.2	[1] 0.10–0.13	8.5–9.0+	Moderate to high.	Moderate.
A–4 or A–6			95–100	90–100	75–85	0.2–0.6	0.18–0.21	5.6–6.5	None	Moderate.
A–6 or A–7			95–100	90–100	85–100	0.06–0.2	0.17–0.20	5.6–6.5	None	High.
A–6 or A–7	0–45	65–85	60–80	60–80	50–75	0.06–0.2	0.18–0.21	5.6–6.5	None	High.
A–4		100	100	80–90	50–70	0.2–0.6	0.18–0.20	6.1–7.3	None	Moderate.
A–7		100	100	95–100	75–90	0.06–0.2	0.17–0.19	6.1–7.3	None	High.
A–6		100	100	90–100	65–75	0.2–0.6	0.18–0.20	6.1–7.3	None	Moderate.
A–4			100	95–100	75–90	0.6–2.0	0.17–0.19	7.9–9.0+	None	Low.
A–6 or A–7			100	95–100	70–85	[1] 0.06–0.2	0.17–0.21	8.5–9.0+	None	Moderate.
A–4 or A–6			100	95–100	75–95	0.6–2.0	[1] 0.05–0.13	7.9–9.0+	High to very high.	Low.
A–6 or A–7			100	95–100	80–100	[1] 0.06–0.2	[1] 0.05–0.13	8.5–9.0+	High to very high.	Moderate.
A–4 or A–6			100	95–100	85–100	0.2–0.6	0.17–0.20	6.6–9.0+	None to moderate.	Low to moderate.
A–4			100	95–100	80–95	0.2–0.6	0.15–0.18	8.5–9.0+	Low to high	Low.
A–7			100	95–100	85–100	0.06–0.2	[1] 0.04–0.09	8.5–9.0+	High to very high.	High.
A–4			100	90–100	80–95	0.2–2.0	[1] 0.04–0.09	8.5–9.0+	Very high	Low to moderate.
A–4			85–100	85–100	75–95	0.2–0.6	0.18–0.21	6.6–7.8	None	Moderate.
A–6			85–100	85–100	75–95	0.2–0.6	0.17–0.20	7.4–8.4	None	Moderate.
A–6 or A–7		100	95–100	95–100	85–100	0.06–0.2	0.18–0.20	7.9–9.0+	None	High.
A–4 or A–2	0–10	40–85	35–80	35–75	30–70	2.0–6.0	0.16–0.20	6.6–8.4	None	Low.
A–2, A–4, or A–1	30–50	30–70	25–65	20–65	20–55	2.0–6.0	0.06–0.08	7.9–9.0+	None	Low.
A–4		75–100	70–95	65–90	50–60	2.0–6.0	0.16–0.19	6.6–7.3	None	Low to moderate.
A–1, A–2, or A–4	0–15	30–75	25–70	20–60	10–50	2.0–6.0	0.10–0.13	6.6–7.3	None	Low.
A–4 or A–2	25–50	60–80	50–70	45–65	30–50	0.6–2.0	0.10–0.13	6.6–8.4	None	Low.
A–2 or A–4	45–75	40–70	30–50	25–45	15–35	0.6–2.0	0.06–0.10	6.6–9.0	None	Low.
A–4 or A–6			100	95–100	75–95	0.6–2.0	0.15–0.18	7.4–9.0+	None to low	Low to moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified
		Inches	*Inches*	*Inches*		
Kearns, high lime variant: KhE	B	60+	60+	0–60	Silt loam and clay loam	ML or CL
Kidman:						
KlA, KlB	B	50–60	60+	0–60	Fine sandy loam	ML or SM
KmA, KmB, KmD, KmE	B	60+	60+	0–16	Loam	ML
				16–60	Fine sandy loam	ML or SM
Kilburn: KnC, KnD, KnE, KnF, KnG, KoB.	A	60+	60+	0–22	Gravelly sandy loam or gravelly loam.	GM
				22–60	Very gravelly sandy loam or very gravelly loamy sand.	GM or GP–GM
Kirkham: Kr	C	20–50	60+	0–16	Silt loam or loam	ML
				16–68	Silty clay loam	CL
Lakeshore: LA	D	0+	60+	0–64	Stratified silty clay loam to fine sandy loam.	ML or CL
*Lasil:						
Lc	C	20–40	60+	0–7	Silt loam	ML
				7–18	Silty clay loam	CL
				18–60	Stratified silty clay loam to very fine sandy loam.	ML
Ld, Lr. For Airport part of Lr, see Airport series.	C	20–40	60+	0–9	Silt loam	ML
				9–60	Silty clay loam	CL
Lewiston: Ls	C	26–40 (undrained)	60+	0–40	Fine sandy loam	SM
		40–60 (drained)		40–70	Loamy fine sand	SM
Logan: Lt	D	15–36 (undrained) 36–60 (drained)	60+	0–60	Silty clay loam	ML, CL, or MH
*Lucky Star: LUE. For Elzinga part, see Elzinga series.	B	60+	60+	0–20	Silt loam	SM or ML
				20–50	Gravelly loam or gravelly clay loam.	GM or GC
				50–60	Very gravelly clay loam	GC
Magna: Ma	D	18–30 (undrained) 30+ (drained)	60+	0–60	Silty clay loam or silty clay.	CL or CH
*Manila: MbC, MbE, MCG, MDG. For Smarts part of MDG, see Smarts series.	C	60+	50+	0–13	Loam	CL or ML
				13–42	Clay or silty clay	CL or CH
				42–57	Very cobbly silt loam	ML or CL
				57	Weathered stone or fractured limestone.	
Martini: Me	B	36–48	60+	0–63	Fine sandy loam to very fine sandy loam.	SM or ML

See footnotes at end of table.

significant in engineering—Continued

Classification—Con. AASHO	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A-4 or A-6	----------	--------	100	95-100	75-90	0. 6-2. 0	0. 15-0. 18	7. 9-9. 0	None to low	Low to moderate.
A-4	----------	90-100	90-100	80-100	40-60	0. 6-2. 0	0. 13-0. 15	7. 4-9. 0+	None	Low.
A-4	----------	90-100	90-100	85-100	60-70	0. 6-2. 0	0. 12-0. 14	7. 4-8. 4	None	Low.
A-4	----------	90-100	90-100	80-100	40-60	0. 6-2. 0	0. 12-0. 14	7. 4-9. 0+	None	Low.
A-2 or A-1	0-15	45-65	35-60	35-50	15-35	>6. 0	0. 07-0. 10	6. 6-7. 8	None	Low.
A-1	15-50	35-55	25-50	15-35	5-20	>6. 0	0. 06-0. 09	6. 6-7. 8	None	Low.
A-4	----------	--------	100	80-100	60-90	0. 2-0. 6	[1] 0. 12-0. 17	7. 9-9. 0+	Low to moderate.	Low to moderate.
A-6 or A-7	----------	--------	100	95-100	75-100	0. 2-0. 6	[1] 0. 12-0. 17	8. 5-9. 0+	Low to moderate.	Moderate to high.
A-4 or A-6	----------	--------	100	95-100	75-90	0. 06-0. 2	[1] 0. 05-0. 09	7. 9-9. 0	Very high	Low.
A-4 or A-6	----------	--------	100	95-100	75-100	0. 2-0. 6	[1] 0. 11-0. 15	7. 4-9. 0+	Moderate to high.	Moderate.
A-6 or A-7	----------	--------	100	95-100	85-100	0. 06-0. 2	[1] 0. 11-0. 15	7. 9-9. 0+	Moderate to high.	Moderate.
A-4 or A-6	----------	--------	100	95-100	75-100	0. 06-0. 2	[1] 0. 11-0. 15	9. 0+	Moderate to high.	Moderate.
A-4 or A-6	----------	--------	100	95-100	75-100	0. 06-0. 2	[1] 0. 11-0. 15	7. 4-9. 0+	Moderate	Moderate.
A-6 or A-7	----------	--------	100	95-100	80-100	0. 06-0. 2	[1] 0. 06-0. 13	7. 9-9. 0+	High to very high.	Moderate.
A-4	----------	--------	100	85-95	35-50	0. 6-2. 0	0. 12-0. 15	7. 4-9. 0	Moderate	Low.
A-2 or A-4	----------	--------	100	80-95	20-50	2. 0-6. 0	0. 08-0. 12	7. 9-9. 0	Moderate	Low.
A-6 or A-7	----------	100	100	95-100	75-100	0. 06-0. 2	[5] 0. 18-0. 20	7. 9-9. 0	None [5]	Moderate to high.
A-4	0-10	80-85	70-80	65-80	45-60	0. 6-2. 0	0. 14-0. 17	6. 1-6. 5	None	Low.
A-4 or A-6	10-30	60-80	50-70	45-65	35-50	0. 6-2. 0	0. 10-0. 15	6. 1-6. 5	None	Low.
A-2	15-45	40-75	25-45	20-45	15-35	0. 6-2. 0	0. 10-0. 13	5. 6-6. 0	None	Low.
A-7	----------	--------	100	90-100	85-100	<0. 06	[1] 0. 15-0. 18	7. 9-9. 0	Moderate	High.
A-4 or A-6	----------	80-100	80-90	70-85	50-65	0. 6-2. 0	0. 18-0. 21	6. 1-8. 4	None	Moderate.
A-7	0-10	80-95	75-90	70-85	65-80	0. 06-0. 2	0. 18-0. 21	6. 1-8. 4	None	High.
A-4 or A-6	0-50	80-100	70-95	65-90	60-80	0. 2-0. 6	0. 18-0. 21	7. 4-9. 0	None	Moderate.
A-4	----------	--------	90-100	70-85	35-60	2. 0-6. 0	0. 09-0. 12	7. 9-9. 0+	None	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified
		Inches	*Inches*	*Inches*		
Maughan. Mapped only in a complex with Elzinga soils.	C	60+	60+	0–24	Silt loam	ML
				24–35	Very cobbly loam	CL or CL–ML
				35–66	Cobbly clay or silty clay	CL
*Mellor: MFB, MGB. For Thiokol part of MGB, see Thiokol series.	D	60+	60+	0–6	Silt loam	ML
				6–48	Silty clay loam or silt loam.	CL
				48–62	Gravelly loamy fine sand	SM or GM
Mendon: MhB, MhD	B	60+	60+	0–12	Silt loam	ML
				12–31	Silty clay loam	CL or CH
				31–62	Silt loam	CL
*Middle: MIE, MIG, MJG, MKE, MKG. For Broad part of MJG, see Broad series; Rock outcrop part of MKE and MKG is too variable to estimate.	C	60+	24–38	0–12	Cobbly silt loam	ML, GM
				12–28	Very cobbly silt loam and very cobbly loam.	GM, GC, ML, or CL
				28	Fractured limestone.	
Millville:						
MlA, MlB	B	60+	60+	0–60	Silt loam	ML
MmB	B	30–60	60+			
Munk: MuE	C	60+	30–40	0–17	Gravelly silt loam	GM or ML
				17–32	Very gravelly sandy clay loam.	GM
				32	Fractured limestone.	
Obray: OBE	D	60+	60+	0–60	Clay	CH
Palisade: PAB, PAD	B	60+	60+	0–30	Silt loam and loam	ML
				30–60	Very fine sandy loam	ML or SM
*Parleys: PbA, PdA, PeA, PeB, PeD, PeE, PlA, PmD, PmE, PnD. For Munk part of PmD and PmE and Pomat part of PnD, see Munk and Pomat series.	B	46–60+	60+	0–11	Silt loam	ML or CL
				11–47	Silty clay loam	CL
				47–60	Loam	ML or CL
Pass Canyon: POE. Rock outcrop part is too variable to estimate.	D	60+	14–20	0–11	Loam and silt loam	ML or CL
				11–20	Cobbly clay loam	CL
				20	Fractured quartzite.	
Payson: Pr	D	32–48	60+	0–6	Silt loam	ML
		48–60+ (drained)		6–14	Clay	CL or CH
				14–60	Loam, clay loam, silt loam, and silty clay loam.	ML or CL
Peteetneet, moderately deep variant: Ps. Onsite investigation needed.	D					
Picayune. Mapped only in an association with Agassiz soils.	B	60+	60+	0–40	Gravelly loam	ML or GM
				40–60	Very gravelly loam	GM, GP–GM, or SM

See footnotes at end of table.

significant in engineering—Continued

Classification—Con.	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
AASHO		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A-4	15-20	90-100	80-100	75-95	60-80	0. 6-2. 0	0. 18-0. 21	6. 1-6. 5	None	Low.
A-4 or A-6	30-65	85-100	80-95	70-90	55-70	0. 6-2. 0	0. 14-0. 17	6. 1-6. 5	None	Low.
A-6	15-45	80-100	65-90	60-85	50-70	0. 06-0. 2	0. 14-0. 17	5. 6-6. 5	None	High to moderate.
A-4	----------	--------	100	95-100	80-100	0. 06-0. 2	0. 15-0. 18	7. 9-9. 0+	Low to high	Moderate.
A-6	----------	100	90-100	85-100	80-100	0. 06-0. 2	[1] 0. 04-0. 10	8. 5-9. 0+	Very high	Moderate.
A-1 or A-2	----------	55-85	50-80	40-70	10-30	0. 6-2. 0	[1] 0. 03-0. 05	7. 9-9. 0+	High	Low.
A-4	----------	--------	100	95-100	80-95	0. 6-2. 0	0. 18-0. 21	7. 4-7. 8	None	Moderate.
A-6 or A-7	----------	--------	100	95-100	85-95	0. 2-0. 6	0. 18-0. 21	7. 4-8. 4	None	Moderate.
A-6	----------	--------	95-100	95-100	75-95	0. 2-2. 0	0. 18-0. 20	7. 4-9. 0	None	Moderate.
A-4	25-40	60-90	55-80	50-75	40-65	0. 6-2. 0	0. 10-0. 13	7. 4-8. 4	None	Low.
A-4 or A-6	30-80	55-75	50-70	45-65	40-60	0. 6-2. 0	0. 10-0. 13	7. 4-9. 0	None	Low.
A-4	----------	--------	100	95-100	75-90	0. 6-2. 0	0. 17-0. 20	7. 9-9. 0	None	Low.
A-2 or A-4	15-35	60-85	50-70	45-65	30-55	0. 6-2. 0	0. 07-0. 10	7. 9-9. 0	None	Low.
A-2	35-65	35-65	25-60	20-45	10-35	0. 6-2. 0	0. 06-0. 09	8. 5-9. 0	None	Low.
A-7	----------	--------	100	90-100	85-95	<0. 06	0. 19-0. 22	6. 1-7. 3	None	High.
A-4	----------	95-100	85-95	70-90	60-85	0. 6-2. 0	0. 18-0. 21	7. 9-9. 0+	None to moderate.	Low.
A-4	----------	85-100	85-95	75-85	40-60	2. 0-6. 0	[1] 0. 02-0. 10	8. 5-9. 0+	Low to very high.	Low.
A-4 or A-6	----------	--------	95-100	95-100	75-95	0. 2-0. 6	0. 17-0. 20	7. 4-8. 4	None	Moderate.
A-6 or A-7	----------	--------	95-100	95-100	80-95	0. 2-0. 6	0. 16-0. 19	7. 4-9. 0	None	Moderate.
A-4 or A-6	----------	--------	95-100	95-100	75-90	0. 2-0. 6	0. 16-0. 19	7. 9-9. 0	None	Moderate.
A-4 or A-6	0-10	90-100	80-100	80-95	60-80	0. 6-2. 0	0. 12-0. 17	6. 6-7. 8	None	Low.
A-6 or A-7	15-45	85-95	80-95	80-95	60-70	0. 6-2. 0	0. 12-0. 17	6. 6-7. 8	None	Low to moderate.
A-4	----------	--------	100	85-95	70-90	0. 6-2. 0	0. 13-0. 18	7. 4-8. 4	None to high	Low.
A-7	----------	--------	100	90-100	75-95	[4] <0. 06	0. 13-0. 18	7. 9-9. 0+	Low to high	High.
A-4 or A-6	----------	--------	100	85-90	70-85	0. 06-2. 0	[1] 0. 08-0. 13	7. 9-9. 0+	Low to high	Moderate.
A-4	----------	60-90	55-85	50-75	35-60	0. 6-2. 0	0. 10-0. 13	7. 4-9. 0	None	Low to moderate.
A-1, A-2, or A-4	----------	25-75	10-70	10-50	5-45	0. 6-2. 0	0. 10-0. 13	7. 9-9. 0	None	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified
		Inches	*Inches*	*Inches*		
Placeritos: PT	C	20–40 (seasonal)	60+	0–6	Silt loam	CL or ML
				6–16	Silty clay loam	CL
				16–62	Stratified silt loam, loam, fine sandy loam.	ML
Playas: PU. Too variable to estimate.						
Pogal: PVC	C	60+	60+	0–60	Silt loam	ML
*Pomat: PwD, PwE, PwG2, PxE, PyE. For Kearns part of PxE and Parleys part of PyE, see Kearns and Parleys series.	C	60+	60+	0–56	Silt loam	ML or CL
				56–65	Fine sandy loam	SM
Promo. Mapped only in an association with Sandall soils.	D	60+	12–20	0–14	Cobbly silt loam or loam	GM
				14	Fractured limestone.	
Red Rock: RdA, ReA, ReB	B	60+	60+	0–84	Silt loam	ML
Refuge: Rf	C	20–40	60+	0–41	Loam or very fine sandy loam.	ML
				41–60	Silty clay	CL or ML
*Richmond: RMG2. For Middle part, see Middle series.	D	60+	11–19	0–16	Very stony and very gravelly loam.	GM
				16	Fractured limestone.	
Ridd: RrE, RrG. Rock outcrop part is too variable to estimate.	C	60+	24–40	0–24	Gravelly sandy loam	GM or SM
				24	Quartzite.	
Rock land: RS. Too variable to estimate.						
Rock outcrop: RT. Too variable to estimate.						
Roshe Springs: Ru	C	0–20 (undrained) 20–40 (drained)	60+	0–60	Silt loam	ML or CL
Rough broken land: Rv. Too variable to estimate.						
Rozlee: RWG. Rock outcrop part is too variable to estimate.	C	60+	24–38	0–18	Cobbly silt loam	ML
				18–30	Very cobbly silt loam	ML or GM
				30	Fractured limestone.	
*Saltair: SA, SB, SC, Sd. For Logan part of SC and Refuge part of Sd, see Logan and Refuge series; Fresh water part of SB is too variable to estimate.	D	0–20	60+	0–60	Stratified silty clay loam or silt loam.	CL

See footnotes at end of table.

significant in engineering—Continued

Classification—Con. AASHO	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A-4 or A-6	----------	--------	100	95-100	85-100	0. 6-2. 0	[1]0. 12-0. 16	7. 9-9. 0+	Moderate-----	Moderate.
A-6	----------	--------	100	90-100	85-95	0. 2-0. 6	[1]0. 04-0. 08	7. 9-9. 0+	High to very high.	Moderate.
A-4	----------	--------	100	90-100	75-95	0. 6-2. 0	0. 04-0. 08	7. 9-9. 0+	High to very high.	Low to moderate.
A-4	----------	--------	100	95-100	75-95	0. 6-2. 0	[1]0. 04-0. 09	7. 9-9. 0+	Low to very high.	Low.
A-4 or A-6 A-2 or A-4	---------- ----------	100 90-100	95-100 80-100	90-95 70-80	75-90 25-50	0. 6-2. 0 2. 0-6. 0	0. 16-0. 19 0. 09-0. 12	7. 9-9. 0+ 8. 5-9. 0+	None to low-- Low---------	Low. Low.
A-2 or A-4	20-70	50-75	45-70	40-65	25-50	2. 0-6. 0	0. 09-0. 13	7. 9-9. 0	None--------	Low.
A-4	----------	--------	100	95-100	85-100	0. 6-2. 0	0. 17-0. 20	6. 6-9. 0	None--------	Low to moderate.
A-4	----------	--------	100	85-100	50-75	0. 6-2. 0	0. 06-0. 10	8. 5-9. 0	Moderate to very high.	Low.
A-4 or A-6	----------	--------	100	95-100	80-95	0. 6-2. 0	0. 04-0. 06	8. 5-9. 0	High to very high.	Low.
A-2 or A-4	35-70	45-75	40-70	35-60	25-50	2. 0-6. 0	0. 08-0. 11	7. 4-9. 0	None--------	Low.
A-1 or A-2	15-35	55-95	50-90	45-65	15-35	2. 0-6. 0	0. 06-0. 11	6. 6-7. 3	None--------	Low.
A-4 or A-6	----------	--------	100	90-100	70-85	0. 6-2. 0	0. 17-0. 20	7. 9-9. 0	None to low--	Low to moderate.
A-4 A-4 or A-2	30-55 55-75	65-85 40-80	65-80 35-75	60-80 35-75	50-70 30-70	2. 0-6. 0 2. 0-6. 0	0. 08-0. 11 0. 06-0. 09	7. 4-9. 0 7. 9-9. 0	None-------- None--------	Low. Low.
A-6 or A-7	----------	--------	100	95-100	85-95	0. 06-0. 2	[1] 0. 04-0. 07	7. 9-9. 0	Very high----	Moderate to high.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified
		Inches	*Inches*	*Inches*		
*Sandall: SEE, SEG, SFG, SGG, SHE, SJG. For Broad part of SFG, Promo part of SGG, and Rozlee part of SJG, see their respective series; Rock outcrop part of SHE is too variable to estimate.	C	60+	22–40	0–35 35	Cobbly silt loam and very cobbly loam. Limestone.	GM
Sanpete: SkE, SIB, SID, SIE, SIG	A	60+	60+	0–19 19–65	Gravelly silt loam Very gravelly loam	GM or ML GM
*Saxby: SMB, SN For Thiokol part of SMB, see Thiokol series; Very stony land part of SN is too variable to estimate.	D	60+	17–20	0–18 18	Extremely stony and very cobbly silt loam. Fractured basalt.	GM or ML
Sheeprock: SoD, SpF3	A	60+	60+	0–14 14–60	Gravelly sandy loam Very gravelly sand	GM or SM GP or GP–GM
Smarts: SQG	B	60+	60+	0–45 45–68	Loam Gravelly or cobbly clay loam.	ML or SM GC or CL
Snowville: SrE	D	60+	[6]14–20	0–18 18–20 20	Gravelly silt loam or cobbly loam. Hardpan. Basalt.	ML or SM
*Sterling: SsB, SsD, SsF, SsG, StE, SuE. For Parleys part of SuE, see Parleys series.	A	60+	60+	0–16 16–60	Gravelly loam Very cobbly or cobbly loam.	GM or ML GM
Stingal: SvB, SvD	B	60+	60+	0–48 48–74	Loam Very fine sandy loam	ML ML or SM
Stokes: Sw.	D D	40–48 (undrained) 40–60 (drained)	60+ 60+	0–11 11–24 24–68	Silt loam Silty clay and clay Silty clay loam	ML CL or CH CL
Stony alluvial land: Sx. Too variable to estimate.						
Sunset: Sy	B	30–40 (undrained) 40+ (drained)	60+	0–33 33–60	Silt loam or loam Loamy fine sand and fine sandy loam.	ML SM
Syracuse: Sz	B	30–40 (undrained) 40–60 (drained)	60+	0–60	Fine sandy loam	SM
Thiokol: ThA, ThB, ThD, TkA, TkB	C	60+	60+	0–60	Silt loam	ML
Timpanogos: TmA, TmB, TnA, ToB, ToC.	B	42–60+	60+	0–60	Silt loam	ML or CL

See footnotes at end of table.

significant in engineering—Continued

Classification—Con. AASHO	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A-4	30-85	55-65	50-60	45-60	40-50	0. 6-2. 0	0. 08-0. 12	7. 9-9. 0+	None	Low.
A-2 or A-4	0-15	55-90	50-85	45-80	30-70	2. 0-6. 0	0. 07-0. 10	7. 9-8. 0	None	Low.
A-1	15-65	40-55	35-50	30-45	20-30	2. 0-6. 0	0. 06-0. 09	8. 5-9. 0+	Low	Low.
A-4	35-40	65-90	60-90	55-85	35-80	0. 6-2. 0	0. 09-0. 14	7. 9-9. 0+	None	Low.
A-1, A-2, or A-4	----------	55-80	45-70	40-60	20-40	>6. 0	0. 06-0. 09	7. 4-9. 0	None	Low.
A-1	----------	25-50	15-35	10-25	0-10	>6. 0	0. 04-0. 07	7. 4-9. 0+	None	Low.
A-4	0-15	70-100	65-90	55-85	45-65	0. 6-2. 0	0. 13-0. 19	7. 4-7. 8	None	Low.
A-6	30-85	70-90	60-80	55-75	45-65	0. 2-2. 0	0. 11-0. 16	7. 9-8. 4	None	Low.
A-4	0-25	75-85	70-80	60-80	35-65	0. 6-2. 0	0. 14-0. 17	7. 9-9. 0	None	Low.
A-2 or A-4	15-30	55-95	50-80	45-75	25-60	2. 0-6. 0	0. 10-0. 15	7. 4-8. 4	None	Low.
A-1 or A-2	30-65	45-65	40-60	35-55	20-35	2. 0-6. 0	0. 04-0. 06	7. 9-9. 0	None	Low.
A-4	----------	100	95-100	95-100	75-85	0. 6-2. 0	0. 13-0. 16	7. 9-9. 0+	None to low	Low.
A-4	----------	80-100	55-100	50-90	55-60	0. 6-2. 0	0. 11-0. 14	8. 5-9. 0+	Moderate	Low.
A-4	----------	--------	100	95-100	75-90	0. 2-0. 6	[1] 0. 12-0. 17	7. 9-9. 0	Low	Moderate.
A-7	----------	--------	100	95-100	85-100	0. 06-0. 2	[1] 0. 12-0. 17	7. 9-9. 0	Moderate	High.
A-6	----------	--------	100	95-100	85-100	0. 2-0. 6	[1] 0. 12-0. 17	7. 9-9. 0	Moderate	Moderate.
A-4	----------	90-100	90-100	85-95	60-70	0. 6-2. 0	0. 15-0. 18	7. 9-9. 0	Low	Low to moderate.
A-2 or A-4	----------	90-100	90-100	75-85	30-50	2. 0-6. 0	0. 13-0. 16	8. 5-9. 0+	Low to moderate.	Low.
A-4	----------	--------	100	70-90	35-50	2. 0-6. 0	0. 11-0. 14	8. 5-9. 0+	Low to moderate.	Low.
A-4	----------	--------	100	95-100	85-100	0. 6-2. 0	0. 16-0. 20	7. 9-9. 0+	None	Low to moderate.
A-4 or A-6	----------	100	90-100	85-100	70-85	0. 6-2. 0	0. 16-0. 20	7. 9-9. 0+	None	Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to— Water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified
		Inches	*Inches*	*Inches*		
Uffens: UF	D	60+	60+	0–60	Silt loam or silty clay loam.	CL
Very stony land: VS. Too variable to estimate.						
Warm Springs: Wa	C	24–40	60+	0–60	Stratified fine sandy loam, silt loam, and loam.	SM, ML, or CL
Wasatch: WcC, WcE	A	60+	60+	0–11	Gravelly sandy loam	SM
				11–60	Gravelly loamy sand and very gravelly sand.	GM, SP–SM, or SM
Wasatch, gravelly subsoil variant: WdG, WeE.	A	60+	60+	0–21	Gravelly sandy loam	GM
				21–60	Very gravelly loamy sand	GP–GM
*Wheelon: WhG, WmE. For Collinston part of WmE, see Collinston series.	D	60+	60+	0–60	Silt loam	ML
Wheelon~~, shallow variant:~~—WlG	D	60+	15–20	0–19	Gravelly silt loam and very cobbly silt loam.	GM or ML
				19	Tuffaceous sandstone.	
Windmill: WnB, WnD, WnE	B	60+	60+	0–23	Gravelly loam	SM
				23–60	Gravelly loamy very fine sand.	GM or GP–GM
Woods Cross:						
Wo	D	20–30	60+	0–60	Silty clay loam	ML or CL
Wr	D	20–30	60+	0–60	Silty clay loam	ML or CL
*Yeates Hollow: YHE, YHG, YRE. For Goring part of YRE, see Goring series.	C	60+	42+	0–14	Cobbly clay loam	CL
				14–42	Very cobbly clay	CH
				42	Fractured sandstone.	

[1] The available water capacity is reduced for these soils because of salt concentrations (electrical conductivity of the saturation extract).
[2] The irrigated soils have a water table at a depth of 26 to 40 inches, and the moisture available to plants is not reduced because of low salinity.
[3] Hardpan.

significant in engineering—Continued

Classification—Con. AASHO	Percentage larger than 3 inches	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos. per cm. at 25° C.*	
A-6	----------	--------	100	90-100	70-85	0. 2-0. 6	[1] 0. 05-0. 12	7. 9-9. 0+	Moderate to very high.	Moderate to high.
A-4	----------	--------	100	90-100	40-70	0. 6-2. 0	0. 12-0. 17	7. 9-9. 0+	Low	Low to moderate.
A-1 or A-2	10-25	70-85	65-80	40-55	25-35	2. 0-6. 0	0. 05-0. 07	6. 6-7. 8	None	Low.
A-1	10-25	60-75	55-70	30-45	5-20	>6. 0	0. 04-0. 06	7. 4-7. 8	None	Low.
A-1 or A-2	----------	55-65	50-65	30-45	15-30	2. 0-6. 0	0. 05-0. 07	6. 6-7. 3	None	Low.
A-1	----------	25-40	15-30	10-20	5-10	>6. 0	0. 04-0. 06	6. 6-7. 3	None	Low.
A-4 or A-6	----------	100	100	95-100	75-95	0. 6-2. 0	0. 15-0. 18	8. 5-9. 0+	None	Moderate.
A-1, A-2, or A-4	15-70	50-85	40-80	35-65	20-60	0. 2-0. 6	0. 06-0. 13	7. 4-9. 0	None	Low.
A-2 or A-1	----------	65-90	45-65	30-50	20-35	2. 0-6. 0	0. 09-0. 12	7. 9-9. 0	None	Low.
A-1	----------	50-60	35-50	35-50	10-25	2. 0-6. 0	0. 07-0. 11	8. 5-9. 0	None	Low.
A-6 or A-7	----------	--------	100	95-100	80-95	[4] 0.06-0. 2	0. 18-0. 20	6. 6-7. 8	None	High.
A-6 or A-7	----------	--------	100	95-100	80-95	[4] 0. 06-0. 2	[1] 0. 11-0. 15	7. 4-8. 4	Moderate	High.
A-6	35-45	80-100	75-95	70-90	60-85	0. 2-0. 6	0. 11-0. 15	5. 6-7. 3	None	High.
A-7	30-80	75-85	70-80	65-80	60-75	0. 06-0. 2	0. 08-0. 11	5. 6-7. 3	None	Moderate.

[4] These fine-textured soils generally have slow permeability, but because of jointing and fine sandy loam lenses, they may have moderately slow permeability.

[5] The Logan soils mapped in association with Saltair (SC) soils have moderate to high salinity, and available moisture capacity is reduced to 0.12 to 0.15.

[6] Hardpan over bedrock.

TABLE 5.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills		
					Trench type	Area type	Sanitary landfill cover materials
Abela: ABE, AEE	Severe: slopes of 6 to 20 percent.	Severe: slopes of 6 to 20 percent; 20 to 80 percent gravel and cobblestones.	Moderate to severe: moderate to high frost-heave potential.	Moderate to severe: moderate to high frost-heave potential; slopes of 6 to 20 percent.	Severe: moderately rapid permeability; 20 to 80 percent gravel and cobblestones.	Severe: moderately rapid permeability.	Poor: 20 to 80 percent gravel and cobblestones.
*Agassiz: AGG. For Picayune soil, see Picayune series.	Severe: slopes of 40 to 70 percent; bedrock at depth of 14 to 19 inches.	Severe: slopes of 40 to 70 percent; 20 to 75 percent gravel and cobblestones.	Severe: slopes of 40 to 70 percent; bedrock at depth of 14 to 19 inches.	Severe: slopes of 40 to 70 percent.	Severe: slopes of 40 to 70 percent; bedrock at depth of 14 to 19 inches; 20 to 75 percent gravel and cobblestones.	Severe: slopes of 40 to 70 percent; moderately rapid permeability.	Poor: 20 to 75 percent gravel and cobblestones; slopes of 40 to 70 percent.
Airport: Ao, Ap, Ar.	Severe: slow to moderately slow permeability; subject to flooding.	Severe: subject to flooding; water table at depth of 26 to 40 inches.	Severe: high frost-heave potential; subject to flooding; water table at depth of 26 to 40 inches.	Severe: high frost-heave potential; water table at depth of 26 to 40 inches.	Severe: water table at depth of 26 to 40 inches.	Severe: water table at depth of 26 to 40 inches.	Fair to poor: high salinity.
Anty: AtB, AtD	Slight to moderate: slopes of 1 to 10 percent.	Moderate to severe: slopes of 1 to 10 percent; moderately rapid permeability.	Slight to moderate: unstable if sloping; slopes of 1 to 10 percent.	Slight to moderate: moderate to high bearing strength; slopes of 1 to 10 percent	Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Good: slopes of 1 to 10 percent.
Arave: AV	Severe: water table at depth of 12 to 30 inches; moderately slow permeability; subject to flooding.	Severe: water table at depth of 12 to 30 inches.	Severe: high frost-heave potential; water table at depth of 12 to 30 inches; poorly drained.	Severe: low bearing capacity; high frost-heave potential; water table at depth of 12 to 30 inches.	Severe: water table at depth of 12 to 30 inches; poorly drained.	Severe: water table at depth of 12 to 30 inches; poorly drained.	Poor: water table at depth of 12 to 30 inches; poorly drained.
Bickmore: BCG	Severe: slopes of 50 to 70 percent; bedrock at depth of 36 to 40 inches.	Severe: slopes of 50 to 70 percent; bedrock at depth of 36 to 40 inches; 10 to 80 percent gravel and cobblestones.	Severe: slopes of 50 to 70 percent; bedrock at depth of 36 to 40 inches.	Severe: slopes of 50 to 70 percent.	Severe: bedrock at depth of 36 to 40 inches; slopes of 50 to 70 percent; 10 to 80 percent gravel and cobblestones.	Severe: slopes of 50 to 70 percent; bedrock at depth of 36 to 40 inches.	Poor: slopes of 50 to 70 percent; bedrock at depth of 36 to 40 inches; 10 to 80 percent gravel and cobblestones.
Bingham: BdB, BeB, BeD.	Slight to moderate: slopes of 1 to 10 percent.	Severe: moderately rapid permeability; slopes of 1 to 10 percent; 5 to 80 percent gravel and cobblestones.	Slight to moderate: slopes of 1 to 10 percent.	Slight to moderate: slopes of 1 to 10 percent.	Severe: moderately rapid permeability; 5 to 80 percent gravel and cobblestones.	Severe: rapid permeability.	Poor: 5 to 80 percent gravel and cobblestones.

See footnotes at end of table.

properties of the soils

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions in the first column of this table]

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: 20 to 80 percent gravel and cobblestones.	Unsuited: excessive fines.	Fair to poor: moderate to high frost-heave potential.	Moderately rapid permeability; slopes of 6 to 20 percent.	High to medium shear strength; fair to good compaction characteristics.	Not applicable; well drained.	Not applicable	Moderately rapid permeability.
Poor: 20 to 75 percent gravel and cobblestones; bedrock at depth of 14 to 19 inches.	Unsuited: excessive fines.	Poor: bedrock at depth of 14 to 19 inches; slopes of 40 to 70 percent.	Slopes of 40 to 70 percent; bedrock at depth of 14 to 19 inches.	Medium to low shear strength; fair to poor compaction characteristics; bedrock at depth of 14 to 19 inches.	Not applicable; somewhat excessively drained.	Not applicable	Not applicable.
Poor: water table at depth of 26 to 40 inches; high salinity.	Unsuited: excessive fines.	Poor: water table at depth of 26 to 40 inches.	Water table at depth of 26 to 40 inches.	Medium to low shear strength; good to poor compaction characteristics.	Somewhat poorly drained; water table at depth of 26 to 40 inches.	Slow intake rate; water table at depth of 26 to 40 inches; alkali affected; needs drainage and reclamation.	Not applicable.
Fair to depth of 26 inches: moderately to strongly alkaline.	Unsuited: excessive fines.	Fair: moderate shear strength; moderate frost-heave potential.	Moderately rapid permeability; slopes of 1 to 10 percent.	Medium to high piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Not applicable; well drained.	Rapid intake rate; slopes of 1 to 10 percent.	Erosion hazard; medium to high piping hazard; unstable if sloping.
Poor: water table at depth of 12 to 30 inches; high pH; moderate to high salinity; poorly drained.	Unsuited: excessive fines.	Poor: low shear strength; water table at depth of 12 to 30 inches; high frost-heave potential; poorly drained.	Water table at depth of 12 to 30 inches; moderate salinity; slopes of 0 to 1 percent.	Medium to low shear strength.	Moderately slow permeability; moderate to high salinity; limited outlets available; poorly drained; water table at depth of 12 to 30 inches.	Slow intake rate; water table at depth of 12 to 30 inches; moderate salinity; needs drainage and reclamation.	Not applicable.
Poor: slopes of 50 to 70 percent.	Poor to unsuited: ML,.CL, GM, or GC.	Poor: slopes of 50 to 70 percent; bedrock at depth of 36 to 40 inches.	Slopes of 50 to 70 percent; bedrock at depth of 36 to 40 inches.	Low to high piping hazard; medium to low shear strength.	Not applicable; well drained.	Not applicable	Not applicable.
Poor: 5 to 80 percent cobblestones and gravel.	Poor to unsuited: GM, GC, or ML.	Good: 0 to 60 percent cobblestones.	Moderately rapid permeability; slopes of 1 to 10 percent.	Low to high shear strength; good to poor compaction characteristics; high to low piping hazard.	Not applicable; well drained.	Rapid intake rate; low available moisture capacity; rolling topography; 5 to 80 percent gravel and cobblestones.	Gravelly: moderately rapid permeability; rolling topography.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
*Blue Star: BgE, BLG. For Blue Star, gravelly subsoil variant, in BLG, see Blue Star, gravelly subsoil variant.	Moderate to severe: slopes of 6 to 60 percent; pollution may be a hazard in places because of permeability in substratum.	Severe: moderately rapid permeability; 20 to 50 percent gravel; slopes of 6 to 60 percent.	Slight to severe: slopes of 6 to 60 percent.	Slight to severe: slopes of 6 to 60 percent.	Severe: slopes of 6 to 60 percent; moderately rapid permeability.	Severe: slopes of 6 to 60 percent; moderately rapid permeability.	Poor: slopes of 6 to 60 percent; 20 to 50 percent gravel.
Blue Star, gravelly subsoil variant: BhD.	Slight to moderate: slopes of 1 to 10 percent; pollution may be a hazard in places because of permeability in substratum.	Severe: rapid permeability; 10 to 70 percent gravel.	Slight to moderate: slopes of 1 to 10 percent.	Slight to moderate: slopes of 1 to 10 percent.	Severe: rapid permeability; 10 to 70 percent gravel.	Severe: rapid permeability.	Poor: 10 to 70 percent gravel.
Borrow pits: Bp. Not rated.							
Bram: BR	Severe: moderately slow permeability; water table at depth of 26 to 40 inches in places when irrigated.	Slight: severe when water table is at depth of 26 to 40 inches.	Severe: high frost-heave potential; water table at depth of 26 to 40 inches in places.	Moderate: moderate bearing strength; high piping hazard; severe when water table is at depth of 26 to 40 inches.	Slight: moderately slow permeability.	Slight	Poor: high salinity and alkali.
*Broad: BSE, BSG, BTG, BUG, BVG. For Manila soil in BTG, Middle soil in BUG, and Smarts soil in BVG, see those series.	Severe: slopes of 20 to 60 percent; bedrock at depth of 30 to 40 inches.	Severe: slopes of 20 to 60 percent; bedrock at depth of 30 to 40 inches; 25 to 80 percent gravel and cobblestones.	Severe: slopes of 20 to 60 percent; high frost-heave potential.	Severe: slopes of 20 to 60 percent; bedrock at depth of 30 to 40 inches; high frost-heave potential.	Severe: slopes of 20 to 60 percent; 25 to 80 percent gravel and cobblestones; bedrock at depth of 30 to 40 inches.	Severe: slopes of 20 to 60 percent.	Poor: slopes of 20 to 60 percent; 25 to 80 percent gravel and cobblestones.
Collett: Co	Severe: slow permeability; water table at depth of 30 to 60 inches.	Severe to moderate: water table at depth of 30 to 60 inches.	Severe: high shrink-swell potential; moderate to high frost-heave potential; low shear strength.	Severe: high shrink-swell potential; moderate to high frost-heave potential; water table at depth of 30 to 60 inches.	Severe: water table at depth of 30 to 60 inches.	Moderate to severe: water table at depth of 30 to 60 inches.	Fair to poor: silty clay loam and silty clay.
*Collinston: CwD. For Wheelon soil, see Wheelon series.	Moderate to severe: moderate permeability; slopes of 6 to 30 percent.	Severe: slopes of 6 to 30 percent.	Severe: high frost-heave potential; slopes of 6 to 30 percent.	Severe: slopes of 6 to 30 percent; high frost-heave potential.	Slight to moderate: slopes of 6 to 30 percent.	Slight to severe: slopes of 6 to 30 percent.	Good to poor: slopes of 6 to 30 percent.
Cudahy: Cy	Severe: hardpan at depth of 23 to 40 inches; water table at depth of 20 to 30 inches; very slow permeability in hardpan.	Severe: water table at depth of 20 to 30 inches; hardpan at depth of 23 to 40 inches.	Severe: high frost-heave potential; water table at depth of 20 to 30 inches; poorly drained.	Severe: high frost-heave potential; water table at depth of 20 to 30 inches.	Severe: hardpan at depth of 23 to 40 inches; water table at depth of 20 to 30 inches.	Severe: water table at depth of 20 to 30 inches.	Poor: water table at depth of 20 to 30 inches; hardpan at depth of 23 to 40 inches.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: slopes of 6 to 60 percent; 20 to 50 percent gravel.	Good to poor: GM, SM, GP, GW, or GP-GM.	Good: slopes of 6 to 60 percent.	Moderately rapid permeability; slopes of 6 to 60 percent.	Low to high compacted permeability; low to high piping hazard; good to poor compaction characteristics.	Not applicable; well drained.	Not applicable.	Moderately rapid to rapid permeability; gravelly.
Poor: 10 to 70 percent gravel.	Good to poor: GM, SM, GP, GW, or GP-GM.	Good	Rapid permeability; slopes of 1 to 10 percent.	Low to high compacted permeability; low to high piping hazard; good to poor compaction characteristics.	Somewhat excessively drained.	Not applicable.	Rapid permeability; gravelly.
Poor: high salinity and alkali.	Unsuited: excessive fines.	Poor: high frost-heave potential.	Most features favorable.	Subject to cracking; low to high piping hazard; medium to low shear strength; unstable if sloping; close compaction control essential.	Moderately slow permeability; good internal drainage; moderately well drained.	Moderate intake rate; erosion hazard; high salinity and alkali; needs drainage and reclamation.	Undulating topography.
Poor: slopes of 20 to 60 percent; 25 to 80 percent gravel and cobblestones.	Unsuited: excessive fines.	Poor: slopes of 20 to 60 percent; high frost-heave potential.	Slopes of 20 to 60 percent; moderate permeability; bedrock at depth of 30 to 40 inches.	Low to high piping hazard; good to poor compaction characteristics; medium to low shear strength.	Not applicable; well drained.	Not applicable.	Not applicable.
Fair to poor: silty clay loam over silty clay.	Unsuited: excessive fines.	Poor: low shear strength; high shrink-swell potential; moderate to high frost-heave potential.	Water table at depth of 30 to 60 inches.	Low to medium shear strength.	Slow permeability; somewhat poorly drained; water table at depth of 30 to 60 inches.	Moderate intake rate; water table at depth of 30 to 60 inches.	Not applicable.
Good to poor: slopes of 6 to 30 percent.	Unsuited: excessive fines.	Poor: high frost-heave potential.	Moderate permeability; slopes of 6 to 30 percent.	High piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; high erosion hazard; slopes of 6 to 30 percent.	Undulating topography; high erosion hazard; unstable if sloping.
Fair to poor: saline; hardpan at depth of 23 to 40 inches; water table at depth of 20 to 30 inches.	Unsuited: excessive fines.	Poor: high frost-heave potential; hardpan at depth of 23 to 40 inches.	Water table at depth of 20 to 30 inches; hardpan at depth of 23 to 40 inches.	High piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Very slow permeability; hardpan at depth of 23 to 40 inches; poorly drained; water table at depth of 20 to 30 inches.	Slow intake rate; hardpan at depth of 23 to 40 inches; water table at depth of 20 to 30 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
Dagor: DaB	Slight to moderate: moderate permeability.	Moderate: moderate permeability; slopes of 3 to 6 percent.	Severe: high frost-heave potential.	Severe: high frost-heave potential.	Slight	Slight	Good
DeJarnet: DgB, DgD.	Slight to moderate: moderate permeability; slopes of 1 to 10 percent.	Moderate to severe: moderate permeability; slopes of 1 to 10 percent; 20 to 90 percent gravel and cobblestones.	Moderate: medium shear strength.	Slight	Moderate to severe: 20 to 90 percent gravel and cobblestones.	Slight	Fair to poor: 20 to 90 percent gravel and cobblestones.
Draper: DrA	Severe: water table at depth of 30 to 42 inches.	Severe: water table at depth of 30 to 42 inches.	Severe: high frost-heave potential; water table at depth of 30 to 42 inches.	Severe: water table at depth of 30 to 42 inches; high frost-heave potential.	Severe: water table at depth of 30 to 42 inches.	Severe: water table at depth of 30 to 42 inches.	Good: water table at depth of 30 to 42 inches; silt loam over silty clay loam.
Drum: DU	Severe: moderately slow permeability.	Slight	Severe: high frost-heave potential.	Severe: high frost-heave potential.	Slight	Slight	Poor: moderate to very high salinity.
Eccles: EcA, EcB, EcD.	Slight to moderate: slopes of 0 to 10 percent.	Severe: slopes of 0 to 10 percent; moderately rapid permeability.	Slight to moderate: slopes of 0 to 10 percent; medium to high shear strength.	Slight to moderate: slopes of 0 to 10 percent.	Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Good to fair: slopes of 0 to 10 percent; none to low salinity.
Eccles, sandy variant: EIB.	Slight [2]	Severe: rapid permeability.	Slight	Slight	Severe: rapid permeability.	Severe: rapid permeability.	Fair: loamy sand
*Elzinga: EMF, ENF. For Maughan soil in ENF and Agassiz soil in EMF, see those series.	Severe: slopes of 25 to 70 percent.	Severe: slopes of 25 to 70 percent; 10 to 70 percent gravel and cobblestones.	Severe: slopes of 25 to 70 percent.	Severe: slopes of 25 to 70 percent.	Severe: slopes of 25 to 70 percent; 10 to 70 percent gravel and cobblestones.	Severe: slopes of 25 to 70 percent.	Poor: slopes of 25 to 70 percent; 10 to 70 percent gravel and cobblestones.
Etil: ETB. This soil is oolitic sand. Onsite investigation needed.							
Fielding: Fd, Fe	Moderate: seasonal high water table at depth of 45 to 60 inches; moderate permeability.	Moderate: water table at depth of 45 to 60 inches; moderate permeability.	Severe: high frost-heave potential; seasonal high water table at depth of 45 to 60 inches.	Moderate: medium bearing strength; seasonal high water table at depth of 45 to 60 inches.	Severe: seasonal high water table at depth of 45 to 60 inches.	Moderate: seasonal high water table at depth of 45 to 60 inches.	Good to fair: water table at depth of 45 to 60 inches; silt loam and silty clay loam.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Good	Unsuited: excessive fines.	Poor: high frost-heave potential.	Moderate permeability.	High piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate.	Not applicable.
Poor: 20 to 90 percent gravel and cobblestones.	Poor to unsuited: ML, GM, or GC.	Good	Moderate permeability; slopes of 1 to 10 percent.	Low to medium compressibility.	Not applicable; well drained.	Not applicable	Not applicable.
Fair: silt loam over silty clay loam.	Unsuited: excessive fines.	Poor: high frost-heave potential.	Moderate permeability; water table at depth of 30 to 42 inches.	Low to high piping hazard; fair to poor compaction characteristics; medium to low shear strength.	Moderate permeability; somewhat poorly drained; water table at depth of 30 to 42 inches.	Moderate intake rate; needs drainage; water table at depth of 30 to 42 inches.	Not applicable.
Poor: moderate to very high salinity.	Unsuited: excessive fines.	Poor: high frost-heave potential.	Moderate permeability.	Low to high piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Not applicable; moderately well drained.	Moderate intake rate; moderate to very high salinity.	Not applicable.
Good to fair: slopes of 0 to 10 percent; none to low salinity.	Unsuited for gravel. Unsuited to poor for sand: SM or ML.	Fair: medium to high shear strength; moderate frost-heave potential.	Moderately rapid permeability; slopes of 0 to 10 percent.	Medium to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Rapid intake rate; slopes of 0 to 10 percent.	Erosion hazard: medium to high piping hazard; unstable if sloping.
Poor: loamy sand	Unsuited for gravel. Poor for sand: SM.	Good	Rapid permeability; slopes of 1 to 6 percent.	Low to medium compressibility; medium to high piping hazard.	Not applicable; well drained.	Rapid intake rate; slopes of 1 to 6 percent.	Medium to high piping hazard.
Poor: slopes of 25 to 70 percent; 10 to 70 percent gravel and cobblestones.	Poor to unsuited: ML, CL, GM, or GC.	Poor: slopes of 25 to 70 percent.	Slopes of 25 to 70 percent; moderate to moderately rapid permeability; bedrock at depth of 60 inches or more.	Low to high piping hazard; low to high shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Not applicable	Not applicable.
Good to fair: seasonal high water table at depth of 45 to 60 inches; silt loam or silty clay loam.	Unsuited: excessive fines.	Poor: high frost-heave potential.	Moderate permeability; seasonal high water table at depth of 45 to 60 inches; slopes of 0 to 3 percent.	High to low piping hazard; medium to low shear strength; mostly fair to poor compaction characteristics.	Moderate permeability; well drained but has water table at depth of 45 to 60 inches.	Moderate intake rate; seasonal high water table at depth of 45 to 60 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
Forsgren: FgB, FgD, FgE.	Severe: slow permeability; slopes of 1 to 20 percent.	Severe to moderate: slopes of 1 to 20 percent.	Severe: high frost-heave potential; high shrink-swell potential; slopes of 1 to 20 percent.	Severe: high frost-heave potential; high shrink-swell potential.	Severe: silty clay subsoil.	Slight to severe: slopes of 1 to 20 percent.	Fair to poor: silt loam over silty clay and silty clay loam.
*Foxol: FHG, FRG. For Elzinga soil in FHG, see Elzinga series; Rock outcrop in FRG not rated.	Severe: slopes of 50 to 70 percent; bedrock at depth of 14 to 20 inches.	Severe: slopes of 50 to 70 percent; 30 to 90 percent gravel and cobblestones.	Severe: slopes of 50 to 70 percent; bedrock at depth of 14 to 20 inches.	Severe: slopes of 50 to 70 percent; bedrock at depth of 14 to 20 inches.	Severe: bedrock at depth of 14 to 20 inches; slopes of 50 to 70 percent; 30 to 90 percent gravel and cobblestones.	Severe: slopes of 50 to 70 percent.	Poor: bedrock at depth of 14 to 20 inches; slopes of 50 to 70 percent; 30 to 90 percent gravel and cobblestones.
Francis: FsB	Slight [2]	Severe: rapid permeability.	Slight	Slight	Severe: rapid permeability.	Severe: rapid permeability.	Fair: loamy fine sand.
Fresh, water marsh: FT. Not rated.							
Fridlo: Fu, Fv	Severe: moderately slow or slow permeability; water table at depth of 30 to 60 inches.	Severe to moderate: water table at depth of 30 to 60 inches.	Severe: high frost-heave potential; seasonal high water table at depth of 30 to 60 inches; low shear strength.	Severe: high frost-heave potential; water table at depth of 30 to 60 inches.	Severe: water table at depth of 30 to 60 inches.	Moderate to severe: water table at depth of 30 to 60 inches.	Poor: low to high salinity and alkali.
Gemson: GcD, GcE, GEE. Rock land in GEE not rated.	Severe: slopes of 6 to 20 percent; slow permeability.	Slight to moderate: slopes of 6 to 20 percent.	Severe: high shrink-swell potential; moderate to high frost-heave potential; slopes of 6 to 20 percent.	Severe: high shrink-swell potential; moderate to high frost-heave potential.	Moderate to severe: silty clay loam over silty clay.	Slight to moderate: slopes of 6 to 20 percent.	Fair to poor: silty clay loam over silty clay.
Gooch: Gh	Severe: slow permeability; subject to surface flooding; water table at depth of less than 20 inches.	Severe: subject to flooding.	Severe: high frost-heave potential; water table at depth of less than 20 inches; subject to flooding; poorly drained.	Severe: high frost-heave potential; water table at depth of less than 20 inches; subject to flooding; poorly drained.	Severe: water table at depth of less than 20 inches; poorly drained.	Severe: water table at depth of less than 20 inches; poorly drained; subject to flooding.	Poor: water table at depth of less than 20 inches; poorly drained; moderate to high salinity and alkali.
*Goring: GLE. For Yeates Hollow soil, see Yeates Hollow series.	Moderate to severe: moderately slow to slow permeability; slopes of 10 to 14 percent.	Severe: slopes of 10 to 40 percent; 25 to 50 percent gravel and cobblestones in substratum.	Severe: high shrink-swell potential; high frost-heave potential; slopes of 10 to 40 percent.	Severe: slopes of 10 to 40 percent; medium to low bearing strength; high shrink-swell potential; high frost-heave potential.	Moderate to severe: slopes of 10 to 40 percent; 25 to 50 percent gravel and cobblestones in substratum; clay loam over clay and gravelly clay.	Moderate to severe: slopes of 10 to 40 percent.	Fair to poor: slopes of 10 to 40 percent; clay loam over clay; 25 to 50 percent gravel and cobblestones in substratum.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: silty clay subsoil.	Unsuited: excessive fines.	Poor: low shear strength; high frost-heave potential.	Slow permeability; high compressibility for dam foundations; slopes of 1 to 20 percent.	Medium to low shear strength.	Not applicable; well drained.	Moderate intake rate; slopes of 1 to 20 percent.	Slow permeability; high shrink-swell potential; medium to low shear strength.
Poor: slopes of 50 to 70 percent; bedrock at depth of 14 to 20 inches; 30 to 90 percent gravel and cobblestones.	Poor: GM	Poor: slopes of 50 to 70 percent; 30 to 90 percent gravel and cobblestones; bedrock at depth of 14 to 20 inches; A-4.	Slopes of 50 to 70 percent; bedrock at depth of 14 to 20 inches.	Low compressibility; high to medium shear strength; fair to good compaction characteristics; susceptible to piping.	Not applicable; somewhat excessively drained.	Not applicable	Not applicable.
Fair: loamy fine sand.	Unsuited for gravel: SM. Poor for sand.	Good	Rapid permeability; slopes of 3 to 6 percent.	Medium to high piping hazard.	Not applicable; somewhat excessively drained.	Very rapid intake rate; low available moisture capacity.	Not applicable.
Poor: low to high salinity and alkali.	Unsuited: excessive fines.	Poor: high frost-heave potential; low shear strength.	Water table at depth of 30 to 60 inches.	Medium to low shear strength; good to poor compaction characteristics; low to high piping hazard.	Moderately slow or slow permeability; high sodium content; limited outlets available; moderately well drained; water table at depth of 30 to 60 inches.	Moderate or slow intake rate; water table at depth of 30 to 60 inches; alkali affected; needs drainage and reclamation.	Not applicable.
Fair to poor: silty clay loam over silty clay.	Unsuited: excessive fines.	Poor: low shear strength; high shrink-swell potential; moderate to high frost-heave potential.	Slopes of 6 to 20 percent.	High to low piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; slopes of 6 to 20 percent.	Slow permeability; high shrink-swell potential; medium to low shear strength; high to low piping hazard.
Poor: water table at depth of less than 20 inches; moderate to high salinity and alkali; poorly drained.	Unsuited: excessive fines.	Poor: low shear strength; high frost-heave potential; water table at depth of less than 20 inches; poorly drained to somewhat poorly drained.	Water table at depth of less than 20 inches.	Low to high piping hazard; low to medium shear strength; good to poor compaction characteristics.	Slow permeability; moderate to high salinity and alkali; limited outlets available; poorly drained; water table at depth of less than 20 inches.	Moderate intake rate; moderate to high salinity and alkali; needs drainage and reclamation; subject to flooding; water table at depth of less than 20 inches.	Not applicable.
Fair to poor: slopes of 10 to 40 percent; clay loam over clay; 25 to 50 percent gravel and cobblestones in substratum.	Unsuited: excessive fines.	Poor: high frost-heave potential; low shear strength; high shrink-swell potential; slopes of 10 to 40 percent.	Slopes of 10 to 40 percent.	Low to medium shear strength; poor to fair compaction characteristics.	Not applicable; well drained.	Not applicable	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills		Sanitary landfill cover materials
					Trench type	Area type	
Goring, brown subsoil variant: GM.	Severe: slow permeability.	Slight	Severe: high shrink-swell potential; high frost-heave potential.	Severe: high shrink-swell potential; high frost-heave potential; medium to low bearing strength.	Severe: loam over silty clay.	Slight	Severe: loam over silty clay.
Gravel pits: Gp. Not rated.							
Greenson: Gr, Gs	Severe: slow to moderate permeability; water table at depth of 30 to 48 inches.	Severe: water table at depth of 30 to 48 inches.	Severe: high frost-heave potential; water table at depth of 30 to 48 inches; medium to low shear strength.	Moderate: high frost-heave potential; water table at depth of 30 to 48 inches.	Severe: water table at depth of 30 to 48 inches.	Severe: water table at depth of 30 to 48 inches.	Good to fair for Gr: water table at depth of 30 to 48 inches; silt loam over stratified silty clay loam and fine sandy loam. Poor for Gs: high to very high salinity and alkali.
Gullied land: GU. Not rated.							
Hansel: HaA, HaB, HaD.	Severe: moderately slow permeability.	Slight to severe: slopes of 0 to 10 percent.	Severe: high frost-heave potential.	Severe: high frost-heave potential.	Slight	Slight	Poor: none to moderate salinity and alkali.
Harding: HD	Moderate to severe: moderate to moderately slow permeability in substratum.	Slight to moderate: moderate to moderately slow permeability in substratum.	Severe: high frost-heave potential; ML or CL; low to medium shear strength.	Severe to medium: low bearing strength; moderate to high shrink-swell potential; high frost-heave potential.	Slight	Slight	Poor: silt loam over silty clay; mostly high to very high salinity and alkali.
*Hendricks: HeB, HeD, HeE, HkD. For Kearns soil in HkD, see Kearns series.	Severe: moderately slow permeability; slopes of 1 to 20 percent.	Moderate to severe: slopes of 1 to 20 percent.	Severe: high frost-heave potential; slopes of 1 to 20 percent.	Severe: high frost-heave potential; slopes of 1 to 20 percent.	Moderate: slopes of 1 to 20 percent; silt loam over silty clay loam.	Slight to severe: slopes of 1 to 20 percent.	Good to poor: slopes of 1 to 20 percent; silt loam over silty clay loam.
Honeyville: Ho	Severe: slow permeability; water table at depth of 30 to 60 inches.	Severe to moderate: water table at depth of 30 to 60 inches.	Severe: moderate to high frost-heave potential; high shrink-swell potential; seasonal high water table at depth of 30 to 60 inches.	Severe: high shrink-swell potential; moderate to high frost-heave potential; low bearing strength; water table at depth of 30 to 60 inches.	Severe: water table at depth of 30 to 60 inches.	Moderate to severe: water table at depth of 30 to 60 inches.	Fair to poor: silty clay loam; water table at depth of 30 to 60 inches; silty clay loam.
Hupp: HpB, HpD, HuC, HuD.	Slight to moderate: slopes of 1 to 10 percent.	Severe: moderately rapid permeability; 5 to 90 percent gravel and cobblestones.	Slight to moderate: slopes of 1 to 10 percent.	Slight to moderate: slopes of 1 to 10 percent.	Severe: moderately rapid permeability; 5 to 90 percent gravel and cobblestones.	Severe: moderately rapid permeability.	Fair to poor: 5 to 90 percent gravel and cobblestones.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Fair to poor: loam over silty clay.	Unsuited: excessive fines.	Severe: high shrink-swell potential; high frost-heave potential.	Most features are favorable.	Low to medium shear strength; poor to fair compaction characteristics.	Not applicable; well drained.	Not applicable.	Not applicable.
Good to fair for Gr: water table at depth of 30 to 48 inches; silt loam over stratified silty clay loam and fine sandy loam. Poor for Gs: high to very high salinity and alkali.	Unsuited: excessive fines.	Poor: medium to low shear strength; low high frost-heave potential.	Water table at depth of 30 to 48 inches.	Low to medium shear strength; low to high piping hazard; good to poor compaction characteristics.	Substratum is stratified with thin layers of fine sandy loam; somewhat poorly drained; water table at depth of 30 to 48 inches.	Moderate to slow intake rate; needs drainage; water table at depth of 30 to 48 inches. Gs has high to very high salinity and alkali.	Undulating topography; high erosion hazard; unstable if sloping.
Poor: none to moderate salinity and alkali.	Unsuited: excessive fines.	Poor: high frost-heave potential.	Slopes of 0 to 10 percent.	Low to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; slopes of 0 to 10 percent; none to moderate salinity and alkali.	Undulating topography; high erosion hazard; unstable if sloping.
Poor: generally high to very high salinity; silt loam over silty clay.	Unsuited: excessive fines.	Poor to medium: low shear strength; high frost-heave potential; moderate to high shrink-swell potential.	Moderately slow to moderate permeability in substratum.	Generally high piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Not applicable; well drained.	Slow intake rate; mostly high to very high salinity and alkali.	Not applicable.
Fair to poor: high clay content; slopes of 1 to 20 percent.	Unsuited: excessive fines.	Poor: high frost-heave potential.	Slopes of 1 to 20 percent.	Low to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; slopes of 1 to 20 percent.	Moderately slow permeabiliy; low to high piping hazard; slopes of 1 to 20 percent.
Fair in upper 36 inches. Poor below depth of 36 inches: high clay content; seasonal high water table.	Unsuited: excessive fines.	Poor: low shear strength; high shrink-swell potential; water table at depth of 30 to 60 inches; moderate to high frost-heave potential.	Water table at depth of 30 to 60 inches.	Medium to low shear strength.	Slow permeability; moderately well drained; water table at depth of 30 to 60 inches.	Moderate intake rate; water table at depth of 30 to 60 inches.	Not applicable.
Fair to poor to a depth of 18 inches; very gravelly.	Poor to unsuited: ML or GM.	Fair: medium to high shear strength.	Moderately rapid permeability; slopes of 1 to 10 percent.	Low to high shear strength; low to medium compressibility; good to poor compaction characteristics; low to high piping hazard.	Not applicable; well drained.	Moderate to rapid intake rate; low available moisture capacity; slopes of 1 to 10 percent; 5 to 90 percent gravel and cobblestones.	Moderately rapid permeability; 5 to 90 percent gravel and cobblestones; rolling topography; slopes of 1 to 10 percent.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for— Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Suitability as a source of— Sanitary landfill cover materials
James Canyon: JaA.	Severe: water table at depth of 30 to 40 inches.	Severe: water table at depth of 30 to 40 inches; moderately rapid permeability; 5 to 70 percent gravel.	Moderate: low to moderate frost-heave potential; water table at depth of 30 to 40 inches; somewhat poorly drained.	Slight to moderate: low to medium bearing strength; water table at depth of 30 to 40 inches; low to moderate frost-heave potential.	Severe: water table at depth of 30 to 40 inches; moderately rapid permeability; contains 5 to 70 percent gravel.	Severe: water table at depth of 30 to 40 inches; moderately rapid permeability.	Fair to poor: water table at depth of 30 to 40 inches; 5 to 70 percent gravel.
Kapod: KaE	Moderate to severe: slopes of 6 to 20 percent; moderate permeability.	Severe: slopes of 6 to 20 percent; 40 to 80 percent gravel, cobblestones, and stones.	Moderate to severe: slopes of 6 to 20 percent.	Moderate to severe: slopes of 6 to 20 percent; stony surface.	Severe: slopes of 6 to 20 percent; 40 to 80 percent gravel, cobblestones, and stones.	Moderate to severe: slopes of 6 to 20 percent.	Poor: 40 to 80 percent gravel, cobblestones, and stones; slopes of 6 to 20 percent.
*Kearns: KeB, KeC, KeD, KeE, KgD. For Stingal soil in KgD, see Stingal series.	Moderate to severe: moderate permeability; slopes of 1 to 20 percent.	Severe to moderate: slopes of 1 to 20 percent.	Severe: high frost-heave potential; unstable on steep slopes; slopes of 1 to 20 percent.	Severe: moderate to low bearing strength; slopes of 1 to 20 percent; high frost-heave potential.	Slight to moderate: slopes of 1 to 20 percent.	Slight to severe: slopes of 1 to 20 percent.	Good to poor: slopes of 1 to 20 percent.
Kearns, high lime variant: KhE.	Moderate to severe: moderate permeability; slopes of 6 to 20 percent.	Severe: slopes of 6 to 20 percent.	Severe: slopes of 6 to 20 percent; high frost-heave potential.	Severe: high frost-heave potential; slopes of 6 to 20 percent.	Slight to moderate: silt loam and clay loam; slopes of 6 to 20 percent.	Moderate to severe: slopes of 6 to 20 percent.	Fair to poor: slopes of 6 to 20 percent; silt loam and clay loam.
Kidman: KlA, KlB, KmA, KmB, KmD, KmE.	Moderate to severe: moderate permeability; slopes of 0 to 20 percent.	Moderate to severe: moderate permeability; slopes of 0 to 20 percent; water table at depth of 50 to 60 inches in some places.	Moderate to severe: slopes of 0 to 20 percent; medium shear strength; moderate frost-heave potential.	Moderate to severe: medium bearing strength; slopes of 0 to 20 percent; moderate frost-heave potential.	Slight to severe: water table at depth of 50 to 60 inches in some places; slopes of 0 to 20 percent.	Slight to severe: water table at depth of 50 to 60 inches in some places; slopes of 0 to 20 percent.	Good to poor: slopes of 0 to 20 percent.
Kilburn: KnC, KnD, KnE, KnF, KnG, KoB.	Slight to severe: slopes of 1 to 60 percent.	Severe: rapid permeability; slopes of 1 to 60 percent; 40 to 80 percent gravel and cobblestones.	Slight to severe: slopes of 1 to 60 percent.	Slight to severe: slopes of 1 to 60 percent.	Severe: rapid permeability; slopes of 1 to 60 percent; 40 to 80 percent gravel and cobblestones.	Severe: rapid permeability; slopes of 1 to 60 percent.	Poor: slopes of 1 to 60 percent; 40 to 80 percent gravel and cobblestones.
Kirkham: Kr	Severe: infrequent flooding; water table at depth of 20 to 50 inches; moderately slow permeability.	Severe to moderate: water table at depth of 20 to 50 inches.	Severe: high frost-heave potential; infrequent flooding; water table at depth of 20 to 50 inches; somewhat poorly drained.	Severe: water table at depth of 20 to 50 inches; high frost-heave potential; infrequent flooding.	Severe: water table at depth of 20 to 50 inches; subject to flooding.	Severe: water table at depth of 20 to 50 inches; subject to flooding.	Fair: water table at depth of 20 to 50 inches; silt loam and silty clay loam; low to moderate salinity and alkali.
Lakeshore: LA	Severe: water table generally at or near the surface; slow permeability; subject to frequent flooding.	Severe: water table generally at or near the surface.	Severe: high frost-heave potential; water table generally at or near the surface; poorly drained.	Severe: water table generally at or near the surface; high frost-heave potential.	Severe: water table generally at or near the surface; subject to frequent flooding.	Severe: water table at or near the surface.	Poor: water table at or near the surface; very high salinity and alkali.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Good to a depth of 35 inches: water table at depth of 30 to 40 inches unless drained.	Poor to unsuited: ML, SM, or GM.	Fair: water table at depth of 30 to 40 inches; poorly drained; moderate to low frost-heave potential.	Moderate to rapid permeability; water table at depth of 30 to 40 inches.	Low to high piping hazard; low to medium shear strength; good to poor compaction characteristics.	Moderately rapid permeability; somewhat poorly drained; water table at depth of 30 to 40 inches.	Moderate intake rate; 5 to 70 percent gravel; needs drainage; water table at depth of 30 to 40 inches.	Not applicable.
Poor to very poor: high gravel content; 10 to 45 percent cobblestones and stones; slopes of 6 to 20 percent.	Poor to unsuited: ML, GM, or GC.	Fair to poor: slopes of 6 to 20 percent; stony surface.	Moderate permeability; slopes of 6 to 20 percent.	Low to high piping hazard; high to low shear strength; low to medium compressibility.	Not applicable; well drained.	Moderate intake rate; slopes of 6 to 20 percent; 40 to 80 percent gravel, cobblestones, and stones.	Low to high piping hazard; slopes of 6 to 20 percent.
Good: some areas are alkali at a depth below 15 inches.	Unsuited: excessive fines.	Poor: high frost-heave potential; slopes of 1 to 20 percent.	Moderate permeability; slopes of 1 to 20 percent.	Low to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; slopes of 1 to 20 percent.	Undulating topography; high erosion hazard; unstable if sloping.
Fair to poor: none to low salinity and alkali; slopes of 6 to 20 percent; silt loam and clay loam.	Unsuited: excessive fines.	Severe: high frost-heave potential; slopes of 6 to 20 percent.	Moderate permeability; slopes of 6 to 20 percent.	Low to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; slopes of 6 to 20 percent.	Undulating topography; erosion hazard; unstable if sloping.
Good to poor: slopes of 0 to 20 percent.	Unsuited: excessive fines.	Fair to medium: medium shear strength; moderate frost-heave potential; slopes of 0 to 20 percent.	Moderate permeability; slopes of 0 to 20 percent.	Low to high piping hazard; medium shear strength; good to poor compaction characteristics.	Moderate permeability; well drained; water table at depth of 50 to 60 inches in some places.	Moderate intake rate; slopes of 0 to 20 percent.	Erosion hazard; low to high piping hazard; unstable if sloping.
Poor: 40 to 80 percent gravel and cobblestones; slopes of 1 to 60 percent.	Poor to unsuited to depth of 22 inches. Good to poor below depth of 22 inches: GP, GM, or GP-GM.	Good: slopes of 1 to 60 percent.	Rapid permeability; slopes of 1 to 60 percent.	High to low compacted permeability.	Not applicable; somewhat excessively drained.	Very rapid intake rate; low available moisture capacity; 40 to 80 percent gravel and cobblestones; slopes of 1 to 60 percent.	Not applicable.
Fair to poor: moderate salinity and alkali; silt loam over silty clay loam.	Unsuited: excessive fines.	Poor: high frost-heave potential; moderate to high shrink-swell potential.	Water table at depth of 20 to 50 inches; infrequent flooding.	Low to medium shear strength; good to poor compaction characteristics; low to high piping hazard.	Moderately slow permeability; limited outlets; somewhat poorly drained; water table at a depth of 20 to 50 inches.	Moderate intake rate; infrequent flooding; low to moderate salinity and alkali; needs drainage and reclamation; water table at a depth of 20 to 50 inches.	Not applicable.
Poor: water table generally at or near the surface; very high salinity and alkali.	Unsuited: excessive fines.	Poor: water table at or near the surface; high frost-heave potential.	Water table at or near the surface.	Low to medium shear strength; good to poor compaction characteristics; low to high piping hazard.	Slow permeability; limited outlets available; very high salinity and alkali; poorly drained; water table at or near the surface.	Not applicable	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
*Lasil: Lc, Ld, Lr. For Airport soil in Lr, see Airport series.	Severe: slow permeability; water table at depth of 20 to 40 inches.	Severe: water table at depth of 20 to 40 inches.	Severe: moderate to high frost-heave potential; somewhat poorly drained; water table at depth of 20 to 40 inches.	Severe: moderate to high frost-heave potential; medium to low shear strength; water table at depth of 20 to 40 inches.	Severe: water table at depth of 20 to 40 inches.	Severe: water table at depth of 20 to 40 inches.	Poor: water table at depth of 20 to 40 inches; moderate to very high salinity and alkali.
Lewiston: Ls	Moderate to severe: water table at depth of 26 to 60 inches.	Severe: water table at depth of 26 to 60 inches; moderately rapid permeability in substratum.	Moderate: water table at depth of 26 to 60 inches; somewhat poorly drained; moderate frost-heave potential.	Moderate to severe: water table at depth of 26 to 60 inches.	Severe: water table at depth of 26 to 60 inches; moderately rapid permeability in substratum.	Severe: water table at depth of 26 to 60 inches; moderately rapid permeability in substratum.	Poor: water table at depth of 26 to 60 inches; moderate salinity and alkali.
Logan: Lt	Severe: slow permeability; water table at depth of 15 to 60 inches.	Severe: water table at depth of 15 to 60 inches.	Severe: high frost-heave potential; moderate to high shrink-swell potential; water table at depth of 15 to 60 inches;, poorly drained.	Severe: low bearing strength; high frost-heave potential; water table at depth of 15 to 60 inches, except where drained.	Severe: water table at depth of 15 to 60 inches.	Severe to moderate: water table at depth of 15 to 60 inches.	Poor: water table at depth of 15 to 60 inches; poorly drained; moderate to high salinity in places.
*Lucky Star: LUE. For Elzinga soil in LUE, see Elzinga series.	Severe: slopes of 25 to 40 percent.	Severe: slopes of 25 to 40 percent; 15 to 65 percent gravel and cobblestones.	Severe: slopes of 25 to 40 percent.	Severe: slopes of 25 to 40 percent.	Severe: slopes of 25 to 40 percent; 15 to 65 percent gravel and cobblestones.	Severe: slopes of 25 to 40 percent.	Poor: slopes of 25 to 40 percent; 15 to 65 percent gravel and cobblestones.
Magna: Ma	Severe: very slow permeability; water table at depth of 18 to 30 inches.	Severe: water table at depth of 18 to 30 inches.	Severe: high shrink-swell potential; moderate to high frost-heave potential; poorly drained; water table at depth of 18 to 30 inches.	Severe: high shrink-swell potential; moderate to high frost-heave potential; water table at depth of 18 to 30 inches.	Severe: water table at depth of 18 to 30 inches; silty clay loam and silty clay.	Severe: water table at depth of 18 to 30 inches.	Poor: water table at depth of 18 to 30 inches; poorly drained; silty clay loam and silty clay; moderate salinity.
*Manila: MbC, MbE, MCG, MDG. For Smarts soil in MDG, see Smarts series.	Severe: slow permeability; slopes of 6 to 60 percent.	Severe: slopes of 6 to 60 percent; 0 to 50 percent gravel and cobblestones.	Severe: high shrink-swell potential; high frost-heave potential: slopes of 6 to 60 percent.	Severe: high frost-heave potential; medium to low bearing strength; slopes of 6 to 60 percent; high shrink-swell potential.	Severe: bedrock at depth of more than 50 inches; slopes of 6 to 60 percent.	Moderate to severe: slopes of 6 to 60 percent.	Poor: slopes of 6 to 60 percent; 0 to 50 percent gravel and cobblestones; clay subsoil.
Martini: Me	Severe: water table at depth of 36 to 48 inches; infrequent flooding.	Severe: moderately rapid permeability; water table at depth of 36 to 48 inches.	Moderate: moderate frost-heave potential; water table at depth of 36 to 48 inches.	Moderate: moderate frost-heave potential; water table at depth of 36 to 48 inches.	Severe: water table at depth of 36 to 48 inches; moderately rapid permeability; subject to flooding.	Severe: water table at depth of 36 to 48 inches; moderately rapid permeability; subject to flooding.	Good

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: moderate to very high salinity and alkali; water table at depth of 20 to 40 inches.	Unsuited: excessive fines.	Poor: low to medium shear strength; water table at depth of 20 to 40 inches; moderate to high frost-heave potential.	Water table at depth of 20 to 40 inches.	Low to medium shear strength; good to poor compaction characteristics; low to high piping hazard.	Slow permeability; moderate to very high salinity and alkali; somewhat poorly drained; water table at depth of 20 to 40 inches.	Slow intake rate; moderate to very high salinity and alkali; water table at depth of 20 to 40 inches.	Not applicable.
Poor: water table at depth of 26 to 60 inches; moderate salinity and alkali.	Unsuited for gravel. Poor to unsuited for sand: SM or ML.	Fair to medium: medium shear strength; moderate frost-heave potential.	Moderately rapid permeability in substratum; water table at depth of 26 to 60 inches.	Medium to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Moderately rapid permeability in substratum; limited outlets; somewhat poorly drained; water table at depth of 26 to 60 inches.	Rapid intake rate; moderate salinity; water table at depth of 26 to 60 inches; needs drainage and reclamation.	Not applicable.
Poor: water table at depth of 15 to 60 inches; poorly drained; moderate to high salinity in places.	Unsuited: excessive fines.	Poor: high frost-heave potential; water table at depth of 15 to 60 inches; moderate to high shrink-swell potential; poorly drained.	Water table at depth of 15 to 60 inches.	Moderate to high shrink-swell potential; fair to poor compaction characteristics; low to medium shear strength; low to high piping hazard.	Slow permeability; limited outlets available; poorly drained; water table at depth of 15 to 60 inches; moderate to high salinity in places.	Slow intake rate; needs drainage; water table at depth of 15 to 60 inches; moderate to high salinity in places.	Not applicable.
Poor: slopes of 25 to 40 percent; 15 to 65 percent gravel and cobblestones.	Poor to unsuited: SM, ML, GM, GC, or CL.	Poor: slopes of 25 to 40 percent.	Moderate permeability; slopes of 25 to 40 percent.	Low to high shear strength; low to high piping hazard; good to poor compaction characteristics; low to medium compressibility.	Not applicable; well drained.	Not applicable	Not applicable.
Poor: water table at depth of 18 to 30 inches; poorly drained; moderate salinity; silty clay loam and silty clay.	Unsuited: excessive fines.	Poor: medium to low shear strength; high shrink-swell potential; water table at depth of 18 to 30 inches; moderate to high frost-heave potential; poorly drained.	Water table at depth of 18 to 30 inches.	High shrink-swell potential; medium to low shear strength; good to poor compaction characteristics.	Slow permeability; poorly drained; water table at depth of 18 to 30 inches; moderate salinity.	Slow intake rate; water table at depth of 18 to 30 inches; moderate salinity.	Not applicable.
Poor: 0 to 50 percent gravel and cobblestones; clay subsoil; slopes of 6 to 60 percent.	Unsuited: excessive fines.	Poor: low to medium shear strength; moderate to high shrink-swell potential; high frost-heave potential; slopes of 6 to 60 percent.	Slopes of 6 to 60 percent; bedrock at depth of more than 50 inches; 0 to 50 percent gravel and cobblestones.	High shrink-swell potential; low to medium shear strength; fair to poor compaction characteristics; low to high piping hazard.	Not applicable; well drained.	Moderate intake rate; slopes of 6 to 60 percent; 0 to 50 percent gravel and cobblestones.	Slow permeability; high shrink-swell potential.
Good	Unsuited for gravel. Unsuited to poor for sand: SM or ML.	Fair: moderate frost-heave potential.	Moderately rapid permeability; water table at depth of 36 to 48 inches.	Medium to high piping hazard; medium to low compressibility; good to poor compaction characteristics.	Moderately rapid permeability; moderately well drained; water table at depth of 36 to 48 inches.	Rapid intake rate; water table at depth of 36 to 48 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
Maughan. Mapped only in a complex with Elzinga soils.	Severe: slopes of 25 to 50 percent; slow permeability.	Severe: slopes of 25 to 50 percent; 10 to 55 percent cobblestones and stones.	Severe: slopes of 25 to 50 percent; 10 to 55 percent cobblestones and stones; moderate to high shrink-swell potential.	Severe: slopes of 25 to 50 percent; moderate to high shrink-swell potential.	Severe: slopes of 25 to 50 percent; 10 to 55 percent cobblestones and stones.	Severe: slopes of 25 to 50 percent.	Poor: slopes of 25 to 50 percent; 10 to 55 percent cobblestones and stones; cobbly clay subsoil.
*Mellor: MFB, MGB. For Thiokol soil in MGB, see Thiokol series.	Severe: slow permeability.	Slight	Moderate to severe: moderate shrink-swell potential; moderate to high frost-heave potential; medium to low shear strength.	Moderate to severe: moderate shrink-swell potential; moderate to high frost-heave potential; medium to low bearing strength.	Moderate: silt loam and silty clay loam.	Slight	Poor: high to very high salinity below depth of 6 inches.
Mendon: MhB, MhD.	Severe: moderately slow to moderate permeability; slopes of 1 to 10 percent.	Moderate to severe: slopes of 1 to 10 percent.	Severe: high frost-heave potential.	Severe: high frost-heave potential.	Moderate: silty clay loam subsoil.	Slight: slopes of 1 to 10 percent.	Good to fair: silt loam over silty clay loam.
*Middle: MIE, MIG, MJG, MKE, MKG. For Broad soil in MJG, see Broad series; Rock outcrop in MKE and MKG not rated.	Severe: slopes of 10 to 70 percent; moderate permeability; bedrock at depth of 24 to 38 inches.	Severe: slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Moderate to severe: slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Severe: slopes of 10 to 70 percent; bedrock at depth of 24 to 38 inches.	Severe: bedrock at depth of 24 to 38 inches; slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Severe to moderate: slopes of 10 to 70 percent.	Poor: slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.
Millville: MIA, MIB	Moderate: moderate permeability.	Moderate: moderate permeability.	Severe: high frost-heave potential.	Severe: moderate bearing strength; high frost-heave potential.	Slight	Slight	Good
MmB	Moderate: moderate permeability; water table at depth of 30 to 60 inches.	Moderate: moderate permeability; water table at depth of 30 to 60 inches.	Severe: high frost-heave potential.	Severe: moderate bearing strength; high frost-heave potential.	Severe: water table at depth of 30 to 60 inches.	Moderate to severe: water table at depth of 30 to 60 inches.	Good: water table at depth of 30 to 60 inches.
Munk: MuE	Moderate to severe: moderate permeability; slopes of 6 to 20 percent; bedrock at depth of 30 to 40 inches.	Severe: slopes of 6 to 20 percent; moderate permeability; 20 to 80 percent gravel, cobblestones, and stones.	Moderate to severe: low to moderate frost-heave potential; slopes of 6 to 20 percent; bedrock at depth of 30 to 40 inches.	Severe: slopes of 6 to 20 percent; high shear strength; bedrock at depth of 30 to 40 inches.	Severe: 20 to 80 percent gravel, cobblestones, and stones; bedrock at depth of 30 to 40 inches.	Moderate to severe: slopes of 6 to 20 percent.	Poor: 20 to 80 percent gravel, cobblestones, and stones; bedrock at depth of 30 to 40 inches.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: slopes of 25 to 50 percent; 10 to 55 percent cobblestones and stones; cobbly clay subsoil.	Unsuited: excessive fines.	Poor: slopes of 25 to 50 percent; 10 to 55 percent cobblestones and stones; moderate to high shrink-swell potential.	Slopes of 25 to 50 percent; 10 to 55 percent cobblestones and stones.	Low to high piping hazard; hauling and compaction difficult because of steep slopes and cobblestones and stones; close compaction control essential.	Not applicable; well drained.	Not applicable	Not applicable.
Poor: high to very high salinity.	Unsuited: excessive fines. Poor below a depth of 48 inches: SM or GM.	Poor: medium to low shear strength; moderate shrink-swell potential; moderate to high frost-heave potential.	Slopes of 1 to 6 percent.	Low to high piping hazard; good to poor compaction characteristics; medium to low shear strength.	Not applicable; well drained.	Not applicable	Not applicable.
Fair to poor: silt loam over silty clay loam.	Unsuited: excessive fines.	Poor: low to medium shear strength; high frost-heave potential.	Slopes of 1 to 10 percent.	Low to medium shear strength; good to poor compaction characteristics; low to high piping hazard.	Not applicable; well drained.	Moderate intake rate; slopes of 1 to 10 percent.	Moderately slow to moderate permeability; high to low piping hazard.
Poor: slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Poor to unsuited: ML, CL, GC, or GM.	Poor: slopes of 10 to 70 percent; bedrock at depth of 24 to 38 inches.	Moderate permeability; fractured sandstone and limestone bedrock at depth of 24 to 38 inches; slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Low to high piping hazard; medium to low shear strength; low to medium compressibility; good to poor compaction characteristics.	Not applicable; well drained.	Not applicable	Not applicable.
Good	Unsuited: excessive fines.	Poor: moderate shear strength; high frost-heave potential.	Moderate permeability.	High piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Not applicable; well drained.	Moderate: rapid intake rate; erosion hazard.	Not applicable.
Good: water table at depth of 30 to 60 inches.	Unsuited: excessive fines.	Poor: moderate shear strength; high frost-heave potential.	Moderate permeability; water table at depth of 30 to 60 inches.	High piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Moderate permeability; moderately well drained; water table at depth of 30 to 60 inches.	Moderate: rapid intake rate; erosion hazard; needs drainage; water table at depth of 30 to 60 inches.	Not applicable.
Poor: slopes of 6 to 20 percent; 20 to 80 percent gravel, cobblestones, and stones.	Poor to unsuited: GM or ML.	Fair: low to moderate frost-heave potential; bedrock at depth of 30 to 40 inches.	Moderate permeability; slopes of 6 to 20 percent; bedrock at depth of 30 to 40 inches; 20 to 80 percent gravel, cobblestones, and stones.	High to low shear strength; low to high piping hazard; low to medium compressibility.	Not applicable; well drained.	Rapid intake rate; low available moisture capacity; slopes of 6 to 20 percent; bedrock at depth of 30 to 40 inches; 20 to 80 percent gravel, cobblestones, and stones.	Low to high piping hazard; 20 to 80 percent gravel, cobblestones, and stones.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
Obray: OBE	Severe: very slow permeability; slopes of 10 to 25 percent.	Severe: slopes of 10 to 25 percent.	Severe: high shrink-swell potential; slopes of 10 to 25 percent.	Severe: high shrink-swell potential; slopes of 10 to 25 percent.	Severe: clay; slopes of 10 to 25 percent.	Moderate to severe: slopes of 10 to 25 percent.	Poor: clay; slopes of 10 to 25 percent.
Palisade: PAB, PAD.	Slight to moderate: moderately rapid permeability in substratum; slopes of 1 to 10 percent.	Severe: moderately rapid permeability in substratum; slopes of 1 to 10 percent.	Severe: medium to low shear strength; high frost-heave potential; slopes of 1 to 10 percent.	Severe to moderate: medium bearing strength; high frost-heave potential.	Severe: moderately rapid permeability in substratum.	Severe: moderately rapid permeability in substratum.	Good to poor: none to very high salinity; 5 to 30 percent gravel.
*Parleys: PbA, PdA, PeA, PeB, PeD, PeE, PlA, PmD, PmE, PnD. For Munk soil in PmD and PmE and Pomat soil in PnD; see those series.	Severe: moderately slow permeability; slopes of 0 to 20 percent.	Moderate to severe: slopes of 0 to 20 percent; water table at depth of 46 to 60 inches or more.	Severe: high frost-heave potential; medium to low shear strength; slopes of 0 to 20 percent; water table at depth of 46 to 60 inches or more.	Severe: high frost-heave potential; slopes of 0 to 20 percent.	Moderate to severe: slopes of 0 to 20 percent; water table at depth of 46 to 60 inches or more.	Moderate to severe: slopes of 0 to 20 percent; water table at depth of 46 to 60 inches or more.	Good to fair: slopes of 0 to 20 percent; silt loam over silty clay loam.
Pass Canyon: POE. Rock outcrop in this mapping unit not rated.	Severe: slopes of 6 to 30 percent; bedrock at depth of 14 to 20 inches.	Severe: slopes of 6 to 30 percent; bedrock at depth of 14 to 20 inches; 0 to 15 percent gravel and as much as 30 percent cobblestones.	Severe: high frost-heave potential; slopes of 6 to 30 percent; bedrock at depth of 14 to 20 inches; as much as 30 percent cobblestones.	Severe: slopes of 6 to 30 percent; bedrock at depth of 14 to 20 inches.	Severe: bedrock at depth of 14 to 20 inches; slopes of 6 to 30 percent; as much as 30 percent cobblestones.	Moderate to severe: slopes of 6 to 30 percent.	Poor: bedrock at depth of 14 to 20 inches; as much as 30 percent cobblestones and stones; slopes of 6 to 30 percent.
Payson: Pr	Severe: slow permeability; water table at depth of 32 to 60 inches; moderate permeability in substratum.	Severe to moderate: water table at depth of 32 to 60 inches.	Severe: high frost-heave potential; high shrink-swell potential; water table at depth of 32 to 60 inches; somewhat poorly drained.	Severe: high frost-heave potential; water table at depth of 32 to 60 inches; high shrink-swell potential.	Severe: water table at depth of 32 to 48 inches; high salinity in some places.	Moderate to severe: water table at depth of 32 to 60 inches.	Poor: clay subsoil; none to high salinity and alkali.
Peteetneet, moderately deep variant: Ps. This soil is peat and muck. Onsite investigation needed.							
Picayune. Mapped only in an association with Agassiz soil.	Severe: slopes of 40 to 70 percent.	Severe: slopes of 40 to 70 percent; 10 to 80 percent gravel.	Severe: slopes of 40 to 70 percent; medium to low shear strength.	Severe: slopes of 40 to 70 percent.	Severe: slopes of 40 to 70 percent; 10 to 80 percent gravel.	Severe: slopes of 40 to 70 percent.	Poor: slopes of 40 to 70 percent; 10 to 80 percent gravel.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: clay	Unsuited: excessive fines.	Poor: high shrink-swell potential.	Slopes of 10 to 25 percent.	Fair to poor compaction characteristics; medium to low shear strength.	Not applicable; well drained.	Moderate initial intake rate because of cracking; slow intake rate after cracks seal; slopes of 10 to 25 percent.	Subject to cracking; high shrink-swell potential.
Good to poor: none to very high salinity; 5 to 30 percent gravel.	Unsuited: excessive fines.	Poor: medium to low shear strength; high frost-heave potential.	Moderately rapid permeability in substratum; slopes of 1 to 10 percent.	Low to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; erosion hazard; none to very high salinity; slopes of 1 to 10 percent.	Undulating topography; erosion hazard; unstable if sloping.
Fair to poor: slopes of 0 to 20 percent; silt loam over silty clay loam.	Unsuited: excessive fines.	Poor: medium to low shear strength; high frost-heave potential; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent; water table at depth of 46 to 60 inches or more.	Low to high piping hazard; low to medium shear strength; good to poor compaction characteristics.	Well drained or moderately well drained; moderately slow permeability; water table at depth of 46 to 60 inches or more.	Slow to moderate intake rate; slopes of 0 to 20 percent; water table at depth of 46 to 60 inches or more.	Low to high piping hazard; erosion hazard; unstable if sloping.
Poor: slopes of 6 to 30 percent; bedrock at depth of 14 to 20 inches; as much as 30 percent cobblestones.	Unsuited: excessive fines.	Poor: slopes of 6 to 30 percent; high frost-heave potential; bedrock at depth of 14 to 20 inches; as much as 30 percent cobblestones.	Moderate permeability; fractured quartzite bedrock at depth of 14 to 20 inches; slopes of 6 to 30 percent.	Low to high piping hazard; low to medium shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Not applicable	Low to high piping hazard; slopes of 6 to 30 percent; bedrock at depth of 14 to 20 inches; as much as 30 percent cobblestones.
Poor: none to high salinity and alkali; water table at depth of 32 to 60 inches; clay subsoil.	Unsuited: excessive fines.	Poor: high frost-heave potential; medium to low shear strength.	Moderate permeability in substratum; water table at depth of 32 to 60 inches.	Low to high piping hazard; low to medium shear strength; poor compaction characteristics.	Slow permeability, moderate in substratum; none to high salinity and alkali; somewhat poorly drained; water table at depth of 32 to 60 inches.	Slow intake rate; none to high salinity and alkali; needs drainage and reclamation; water table at depth of 32 to 60 inches.	Not applicable.
Poor: slopes of 40 to 70 percent; 10 to 80 percent gravel.	Fair to unsuited: ML, CL, GM, or GP-GM.	Poor: slopes of 40 to 70 percent.	Moderate permeability; slopes of 40 to 70 percent.	Low to high shear strength; low to high piping hazard; good to poor compaction characteristics; low to high compressibility.	Not applicable; well drained.	Not applicable	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills		Sanitary landfill cover materials
					Trench type	Area type	
Placeritos: PT	Severe: seasonal high water table at depth of 20 to 40 inches; subject to flooding.	Severe: seasonal high water table at depth of 20 to 40 inches; subject to flooding.	Severe: high frost-heave potential; subject to flooding; seasonal high water table at depth of 20 to 40 inches; somewhat poorly drained.	Severe: low to medium bearing strength; high frost-heave potential; seasonal high water table at depth of 20 to 40 inches.	Severe: seasonal high water table at depth of 20 to 40 inches; subject to flooding.	Severe: seasonal high water table at depth of 20 to 40 inches; subject to flooding.	Poor: moderate to very high salinity; seasonal high water table at depth of 20 to 40 inches; silty clay loam substratum.
Playas: PU. Not rated.							
Pogal: PVC	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	Severe: high frost-heave potential; medium to low shear strength.	Severe: moderate bearing strength; high frost-heave potential.	Slight	Slight	Fair to poor: low to very high salinity.
*Pomat: PwD, PwE, PwG2, PxE, PyE. For Kearns soil in PxE and Parleys soil in PyE, see those series.	Moderate to severe: slopes of 6 to 40 percent.	Severe: slopes of 6 to 40 percent; moderately rapid permeability in substratum.	Severe: high frost-heave potential; medium to low shear strength; slopes of 6 to 40 percent.	Severe: high frost-heave potential; slopes of 6 to 40 percent.	Severe: slopes of 6 to 40 percent; moderately rapid permeability in substratum.	Moderate to severe: slopes of 6 to 40 percent; none to low salinity.	Fair to poor: slopes of 6 to 40 percent; none to low salinity.
Promo. Mapped only in an association with Sandall soils.	Severe: slopes of 30 to 60 percent; bedrock at depth of 12 to 20 inches.	Severe: slopes of 30 to 60 percent; moderately rapid permeability; bedrock at depth of 12 to 20 inches; 30 to 80 percent gravel and cobblestones.	Severe: slopes of 30 to 60 percent; bedrock at depth of 12 to 20 inches.	Severe: slopes of 30 to 60 percent; bedrock at depth of 12 to 20 inches.	Severe: bedrock at depth of 12 to 20 inches; slopes of 30 to 60 percent; 30 to 80 percent gravel and cobblestones; moderately rapid permeability.	Severe: slopes of 30 to 60 percent; moderately rapid permeability.	Poor: bedrock at depth of 12 to 20 inches; slopes of 30 to 60 percent; 30 to 80 percent gravel and cobblestones.
Red Rock: RdA, ReA, ReB.	Slight to moderate: moderate permeability.	Moderate: slopes of 0 to 6 percent; moderate permeability.	Severe: high frost-heave potential.	Severe: moderate bearing strength; high frost-heave potential.	Slight	Slight	Good
Refuge: Rf	Severe: moderate permeability; water table at depth of 20 to 40 inches; subject to infrequent flooding.	Severe: water table at depth of 20 to 40 inches.	Severe: moderate to high frost-heave potential; water table at depth of 20 to 40 inches; somewhat poorly drained.	Severe: moderate to high frost-heave potential; water table at depth of 20 to 40 inches.	Severe: water table at depth of 20 to 40 inches.	Severe: water table at depth of 20 to 40 inches.	Poor: water table at depth of 20 to 40 inches; moderate to very high salinity.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: moderate to very high salinity; seasonal high water table at depth of 20 to 40 inches.	Unsuited: excessive fines.	Poor: low to medium shear strength; high frost-heave potential; seasonal high water table at depth of 20 to 40 inches.	Moderate permeability; water table at depth of 20 to 40 inches.	Low to medium shear strength; good to poor compaction characteristics; low to high piping hazard.	Moderate permeability; limited outlets; moderate to very high salinity; somewhat poorly drained; seasonal high water table at depth of 20 to 40 inches.	Moderate intake rate; subject to flooding; moderate to very high salinity; needs drainage and reclamation; seasonal high water table at depth of 20 to 40 inches.	Not applicable.
Poor: moderately to very strongly alkaline; low to very high salinity.	Unsuited: excessive fines.	Poor: medium to low shear strength; high frost-heave potential.	Moderate permeability; undulating topography.	Medium to high piping hazard; medium to low shear strength; good to poor compaction characteristics; low to medium compressibility.	Not applicable; well drained.	Moderate intake rate; erosion hazard; high to to very high salinity.	Not applicable.
Fair to poor: slopes of 6 to 40 percent; none to low salinity.	Unsuited for gravel. Poor to unsuited for sand: ML, CL, and SM.	Poor: high frost-heave potential; medium to low shear strength; slopes of 6 to 40 percent.	Moderately rapid permeability in substratum; slopes of 6 to 40 percent.	Medium to high piping hazard; low to medium shear strength; good to poor compaction characteristics; low to medium compressibility.	Not applicable; well drained.	Not applicable.	Medium to high piping hazard; erosion hazard; slopes of 6 to 40 percent.
Very poor: 30 to 80 percent gravel and cobblestones; slopes of 30 to 60 percent; bedrock at depth of 12 to 20 inches.	Poor: GM or SM.	Poor: slopes of 30 to 60 percent; bedrock at depth of 12 to 20 inches.	Moderately rapid permeability; fractured limestone bedrock at depth of 12 to 20 inches; slopes of 30 to 60 percent.	Low to high piping hazard; low to medium compressibility.	Not applicable; somewhat excessively drained.	Not applicable.	Not applicable.
Good.	Unsuited: excessive fines.	Poor: moderate to low shear strength; high frost-heave potential.	Moderate permeability; slopes of 0 to 6 percent.	Low to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Not applicable.	Not applicable.
Poor: moderate to very high salinity; water table at depth of 20 to 40 inches.	Unsuited: excessive fines.	Poor: moderate to low shear strength; moderate to high frost-heave potential; water table at depth of 20 to 40 inches.	Moderate permeability; water table at depth of 20 to 40 inches.	Low to high piping hazard; medium to low shear strength; good to poor compaction characteristics.	Moderate permeability; moderate to very high salinity; limited outlets available; somewhat poorly drained; water table at depth of 20 to 40 inches.	Moderate intake rate; moderate to very high salinity; needs drainage and reclamation; water table at depth of 20 to 40 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills		Sanitary landfill cover materials
					Trench type	Area type	
*Richmond: RMG2. For Middle soil in RMG2, see Middle series.	Severe: slopes of 30 to 70 percent; bedrock at depth of 11 to 19 inches.	Severe: slopes of 30 to 70 percent; bedrock at depth of 11 to 19 inches; 25 to 80 percent gravel, cobblestones, and stones.	Severe: slopes of 30 to 70 percent; bedrock at depth of 11 to 19 inches.	Severe: slopes of 30 to 70 percent; bedrock at depth of 11 to 19 inches.	Severe: bedrock at depth of 11 to 19 inches; slopes of 30 to 70 percent; moderately rapid permeability; 25 to 80 percent gravel, cobblestones, and stones.	Severe: slopes of 30 to 70 percent.	Poor: slopes of 30 to 70 percent; bedrock at depth of 11 to 19 inches; 25 to 80 percent gravel, cobblestones, and stones.
Ridd: RrE, RrG. Rock outcrop in these mapping units not rated.	Severe: slopes of 10 to 70 percent; bedrock at depth of 24 to 40 inches.	Severe: slopes of 10 to 70 percent; moderately rapid permeability; bedrock at depth of 24 to 40 inches; 10 to 70 percent gravel, cobblestones, and stones.	Moderate to severe: slopes of 10 to 70 percent; bedrock at depth of 24 to 40 inches.	Severe: slopes of 10 to 70 percent; bedrock at depth of 24 to 40 inches.	Severe: bedrock at depth of 24 to 40 inches; slopes of 10 to 70 percent; 10 to 70 percent gravel, cobblestones, and stones; moderately rapid permeability.	Moderate to severe: slopes of 10 to 70 percent; moderately rapid permeability.	Poor: slopes of 10 to 70 percent; bedrock at depth of 24 to 40 inches; 10 to 70 percent gravel, cobblestones, and stones.
Rock land: RS. Not rated.							
Rock outcrop: RT. Not rated.							
Roshe Springs: RJ.	Severe: water table generally at depth of 0 to 20 inches.	Severe: water table generally at depth of 0 to 20 inches.	Severe: high frost-heave potential; water table generally at depth of 0 to 20 inches; poorly drained.	Severe: high frost-heave potential; water table generally at depth of 0 to 20 inches.	Severe: water table generally at depth of 0 to 20 inches undrained.	Severe: water table generally at depth of 0 to 20 inches undrained.	Poor: water table at depth of 0 to 20 inches; poorly and very poorly drained.
Rough broken land: Rv. Not rated.							
Rozlee: RWG. Rock outcrop in this mapping unit not rated.	Severe: slopes of 30 to 70 percent; bedrock at depth of 24 to 38 inches.	Severe: slopes of 30 to 70 percent; bedrock at depth of 24 to 38 inches; moderately rapid permeability; 20 to 80 percent gravel and cobblestones.	Severe: slopes of 30 to 70 percent; bedrock at depth of 24 to 38 inches; moderately rapid permeability; 20 to 80 percent gravel and cobblestones.	Severe: slopes of 30 to 70 percent; bedrock at depth of 24 to 38 inches.	Severe: bedrock at depth of 24 to 38 inches; slopes of 30 to 70 percent; 20 to 80 percent gravel and cobblestones; moderately rapid permeability.	Severe: slopes of 30 to 70 percent; moderately rapid permeability.	Poor: slopes of 30 to 70 percent; bedrock at depth of 24 to 38 inches; 20 to 80 percent gravel and cobblestones.
*Saltair: SA, SB, SC, Sd. For Logan soil in SC and Refuge soil in Sd, see those series; Fresh water marsh in SB not rated.	Severe: water table at depth of 0 to 20 inches; slow permeability; subject to frequent flooding.	Severe: water table at depth of 0 to 20 inches.	Severe: water table at depth of 0 to 20 inches; moderate to high shrink-swell potential; poorly drained.	Severe: water table at depth of 0 to 20 inches; moderate to high shrink-swell potential.	Severe: water table at depth of 0 to 20 inches; subject to frequent flooding.	Severe: subject to frequent flooding; water table at depth of 0 to 20 inches.	Poor: water table at depth of 0 to 20 inches; very high salinity; poorly drained.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: slopes of 30 to 70 percent; 25 to 80 percent gravel, cobblestones, and stones; bedrock at depth of 11 to 19 inches.	Unsuited: excessive fines.	Poor: 20 to 80 percent gravel, cobblestones, and stones; slopes of 30 to 70 percent; bedrock at depth of 11 to 19 inches.	Moderately rapid permeability; fractured limestone bedrock at depth of 11 to 19 inches; slopes of 30 to 70 percent; 25 to 80 percent gravel, cobblestones, and stones.	Low to high piping hazard; high to low shear strength; good to poor compaction characteristics; low to medium compressibility.	Not applicable; excessively drained.	Not applicable	Not applicable.
Poor: slopes of 10 to 70 percent; 10 to 70 percent gravel, cobblestones, and stones; bedrock at depth of 24 to 40 inches.	Poor: SM or GM	Fair to poor: bedrock at depth of 24 to 40 inches; slopes of 10 to 70 percent.	Moderately rapid permeability; slopes of 10 to 70 percent; bedrock at depth of 24 to 40 inches.	Low to high piping hazard; low to medium compressibility.	Not applicable; well drained.	Not applicable	Not applicable.
Poor: water table at depth of 0 to 20 inches undrained; poorly drained.	Unsuited: excessive fines.	Poor: high frost-heave potential; water table generally at depth of 0 to 20 inches; poorly drained.	Moderate permeability; water table generally at depth of 0 to 20 inches.	High organic-matter content; low to high piping hazard; close compaction control essential; low to medium shear strength.	Moderate permeability; limited outlets available; poorly drained; water table generally at depth of 0 to 20 inches.	Moderate intake rate; high organic-matter content; needs drainage; water table generally at depth of 0 to 20 inches.	Not applicable.
Poor: slopes of 30 to 70 percent; 20 to 80 percent gravel and cobblestones; bedrock at depth of 24 to 38 inches.	Unsuited: excessive fines.	Poor: slopes of 30 to 70 percent; bedrock at depth of 24 to 38 inches.	Slopes of 30 to 70 percent; moderately rapid permeability; bedrock at depth of 24 to 38 inches.	High piping hazard; low to medium shear strength; cobblestones and stones may hinder hauling operations.	Not applicable; well drained.	Not applicable	Not applicable.
Poor: very high salinity; water table at depth of 0 to 20 inches.	Unsuited: excessive fines.	Poor: poorly drained; water table at depth of 0 to 20 inches.	Water table at depth of 0 to 20 inches	Medium to low shear strength.	Very strongly affected by salt and alkali; no outlets available; slow permeability; poorly drained; water table at depth of 0 to 20 inches.	Unsuited; water table at depth of 0 to 20 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
*Sandall: SEE, SEG, SFG, SGG, SHE, SJG. For Broad soil in SFG, Promo soil in SGG, and Rozlee soil in SJG, see those series; Rock outcrop in SHE not rated.	Moderate to severe: slopes of 3 to 60 percent; bedrock at depth of 22 to 40 inches.	Severe: slopes of 3 to 60 percent; bedrock at depth of 22 to 40 inches; 25 to 90 percent gravel and cobblestones.	Moderate to severe: slopes of 3 to 60 percent; bedrock at depth of 22 to 40 inches.	Severe: slopes of 3 to 60 percent; bedrock at depth of 22 to 40 inches.	Severe: bedrock at depth of 22 to 40 inches; slopes of 3 to 60 percent; 25 to 90 percent gravel and cobblestones.	Slight to severe: slopes of 3 to 60 percent.	Poor: bedrock at depth of 22 to 40 inches; slopes of 3 to 60 percent; 25 to 90 percent gravel and cobblestones.
Sanpete: SkE, SIB, SID, SIE, SIG.	Slight to severe: slopes of 1 to 50 percent.	Severe: slopes of 1 to 50 percent; moderately rapid permeability; 20 to 80 percent gravel and cobblestones.	Slight to severe: slopes of 1 to 50 percent.	Slight to severe: slopes of 1 to 50 percent.	Severe: slopes of 1 to 50 percent; moderately rapid permeability; 20 to 80 percent gravel and cobblestones.	Severe: slopes of 1 to 50 percent; moderately rapid permeability.	Poor: 20 to 80 percent gravel and cobblestones; slopes of 1 to 50 percent.
*Saxby: SMB, SN. For Thiokol soil in SMB see Thiokol series; Very stony land in SN not rated.	Severe: bedrock at depth of 17 to 20 inches; slopes of 1 to 30 percent.	Severe: slopes of 1 to 30 percent; 40 to 85 percent cobblestones and stones.	Severe: 40 to 85 percent cobblestones and stones; bedrock at depth of 17 to 20 inches; slopes of 1 to 30 percent.	Severe: slopes of 1 to 30 percent; bedrock at depth of 17 to 20 inches; 40 to 85 percent cobblestones and stones.	Severe: bedrock at depth of 17 to 20 inches; 40 to 85 percent cobblestones and stones.	Severe: 40 to 85 percent cobblestones and stones; slopes of 1 to 30 percent.	Poor: bedrock at depth of 17 to 20 inches; 40 to 85 percent cobblestones and stones.
Sheeprock: SoD, SpF3.	Moderate to severe: slopes of 6 to 40 percent; pollution of ground water may be a problem.	Severe: rapid permeability; slopes of 6 to 40 percent; 20 to 80 percent gravel.	Slight to severe: slopes of 6 to 40 percent.	Slight to severe: slopes of 6 to 40 percent.	Severe: rapid permeability; 20 to 80 percent gravel; slopes of 6 to 40 percent.	Severe: rapid permeability; slopes of 6 to 40 percent.	Poor: 20 to 80 percent gravel; slopes of 6 to 40 percent.
Smarts: SQG	Severe: slopes of 30 to 70 percent; moderately slow to moderate permeability.	Severe: slopes of 30 to 70 percent; 0 to 80 percent gravel, cobblestones, and stones.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent; 0 to 80 percent gravel, cobblestones, and stones.	Severe: slopes of 30 to 70 percent.	Poor: slopes of 30 to 70 percent; 0 to 80 percent gravel, cobblestones, and stones.
Snowville: SrE	Severe: hardpan and bedrock at depth of 14 to 20 inches; very slow permeability; slopes of 6 to 20 percent.	Severe: slopes of 6 to 20 percent; hardpan and bedrock at depth of 14 to 20 inches.	Severe: slopes of 6 to 20 percent; hardpan and bedrock at depth of 14 to 20 inches.	Severe: slopes of 6 to 20 percent; hardpan and bedrock at depth of 14 to 20 inches.	Severe: hardpan and bedrock at depth of 14 to 20 inches: slopes of 6 to 20 percent.	Moderate to severe; slopes of 6 to 20 percent.	Poor: hardpan and bedrock at depth of 14 to 20 inches; 15 to 35 percent gravel and cobblestones.
*Sterling: SsB, SsD, SsF, SsG, StE, SuE. For Parleys soil in SuE, see Parleys series.	Slight to severe: slopes of 1 to 50 percent.	Severe: slopes of 1 to 50 percent; moderately rapid permeability; 20 to 80 percent gravel and cobblestones.	Slight to severe: slopes of 1 to 50 percent.	Slight to severe: slopes of 1 to 50 percent.	Severe: moderately rapid permeability; slopes of 1 to 50 percent; 20 to 80 percent gravel and cobblestones.	Severe: moderately rapid permeability; slopes of 1 to 50 percent.	Poor: 20 to 80 percent gravel and cobblestones; slopes of 1 to 50 percent.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: 25 to 90 percent gravel and cobblestones; slopes of 3 to 60 percent.	Unsuited: excessive fines.	Fair to poor: bedrock at depth of 22 to 40 inches; slopes of 3 to 60 percent.	Moderate permeability; slopes of 3 to 60 percent; bedrock at depth of 22 to 40 inches.	High piping hazard; medium to low shear strength; fair to poor compaction characteristics.	Not applicable; somewhat excessively drained.	Not applicable	High piping hazard; slopes of 3 to 60 percent; 25 to 90 percent gravel and cobblestones; bedrock at depth of 22 to 40 inches.
Poor: 20 to 80 percent gravel and cobblestones; slopes of 1 to 50 percent.	Poor to unsuited: GM or MC.	Poor to good: high shear strength; good compaction; characteristics; slopes of 1 tc 50 percent.	Moderately rapid permeability; slopes of 1 to 50 percent.	Low to high shear strength; good to poor compaction characteristics.	Not applicable; somewhat excessively drained.	Rapid intake rate; low available moisture capacity; slopes of 1 to 50 percent.	Moderately rapid permeability; 20 to 80 percent gravel and cobblestones.
Poor: 40 to 80 percent gravel and stones; slopes of 1 to 30 percent.	Unsuited: excessive fines.	Poor: 40 to 85 percent cobblestones and stones; bedrock at depth of 17 to 20 inches; slopes of 1 to 30 percent.	Moderate permeability; slopes of 1 to 30 percent; bedrock at depth of 17 to 20 inches; 40 to 85 percent cobblestones and stones.	Low to high piping hazard; 40 to 85 percent cobblestones and stones; high to low shear strength; low to medium compressibility; good to poor compaction characteristics.	Not applicable; well drained.	Not applicable	Low to high piping hazard; unstable if sloping; 40 to 85 percent cobblestones and stones.
Poor: slopes of 6 to 40 percent; 20 to 80 percent gravel.	Good to poor: SM, GM, or GP.	Good to poor: slopes of 6 to 40 percent.	Rapid permeability; slopes of 6 to 40 percent; 20 to 80 percent gravel.	High compacted permeability; low to medium compressibility; low to high piping hazard.	Not applicable; somewhat excessively drained.	Not applicable	Not applicable.
Poor: slopes of 30 to 70 percent; 0 to 80 percent gravel, cobblestones, and stones.	Poor to unsuited: ML, CL, SM, GC, or GM.	Poor: slopes of 30 to 70 percent.	Moderately slow to moderate permeability; slopes of 30 to 70 percent; 0 to 80 percent gravel, cobblestones, and stone.	Low to high piping hazard; good to poor compaction characteristics; low to high shear strength; low to medium compressibility.	Not applicable; well drained.	Not applicable	Not applicable.
Poor: slopes of 6 to 20 percent; 15 to 35 percent gravel and cobblestones; hardpan and bedrock at depth of 14 to 20 inches.	Unsuited	Poor: slopes of 6 to 20 percent; hardpan and bedrock at depth of 14 to 20 inches.	Moderate permeability; slopes of 6 to 20 percent; hardpan and bedrock at depth of 14 to 20 inches.	Medium to high piping hazard; medium to low shear strength; good to poor compaction characteristics; low to medium compressibility.	Not applicable; well drained.	Slow intake rate; low available moisture capacity; hardpan and bedrock at depth of 14 to 20 inches; slopes of 6 to 20 percent.	Medium to high piping hazard; erosion hazard; unstable if sloping; slopes of 6 to 20 percent; 15 to 35 percent gravel and cobblestones.
Poor: slopes of 1 to 50 percent; 20 to 80 percent gravel and cobblestones.	Poor to unsuited: GM or ML.	Good to poor: slopes of 1 to 50 percent.	Moderately rapid permeability; slopes of 1 to 50 percent.	Low to high shear strength; low to medium compressibility; good to poor compaction characteristics; low to high piping hazard.	Somewhat excessively drained.	Very rapid intake rate; low available moisture capacity; slopes of 1 to 50 percent; 20 to 80 percent gravel and cobblestones.	Moderately rapid permeability; slopes of 1 to 50 percent; 20 to 80 percent gravel and cobblestones.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
Stingal: SvB, SvD	Slight to moderate: moderate permeability.	Moderate to severe: slopes of 1 to 10 percent; moderate permeability.	Severe: high frost-heave potential.	Severe: medium bearing strength; high frost-heave potential.	Slight	Generally slight; slopes of 0 to 10 percent.	Good: 15 to 35 percent gravel and cobblestones at depth below 40 inches.
Stokes: Sw	Severe: slow to moderately slow permeability; water table at depth of 40 to 60 inches.	Moderate: water table at depth of 40 to 60 inches.	Severe: high frost-heave potential; water table at depth of 40 to 60 inches; ML or CL.	Severe: high frost-heave potential; water table at depth of 40 to 60 inches.	Severe: water table at depth of 40 to 60 inches.	Moderate: water table at depth of 40 to 60 inches.	Fair to poor: water table at depth of 40 to 60 inches; difficult to excavate and spread.
Stony alluvial land Sx. Not rated.							
Sunset: S	Severe unless drained: water table at depth of 30 to 40 inches; moderate to moderately rapid permeability.	Severe: water table at depth of 30 to 40 inches.	Severe: high frost-heave potential; water table at depth of 30 to 40 inches; somewhat poorly drained; SM or ML or CL.	Severe: high frost-heave potential; water table at depth of 30 to 40 inches.	Severe: water table at depth of 30 to 40 inches; moderate to moderately rapid permeability below depth of 38 inches; subject to flooding.	Severe: water table at depth of 30 to 40 inches; subject to flooding.	Good: water table at depth of 30 to 40 inches may hinder excavation; subject to flooding.
Syracuse: Sz	Moderate to severe: moderately rapid permeability; water table at depth of 30 to 60 inches.	Severe: moderately rapid permeability; subject to piping; water table at depth of 30 to 60 inches.	Moderate: if sloping, unstable when saturated; water table at depth of 30 to 60 inches; somewhat poorly drained; SM.	Moderate: moderate shear strength; water table at depth of 30 to 60 inches.	Severe: water table at depth of 30 to 60 inches; moderately rapid permeability.	Severe: water table at depth of 30 to 60 inches; moderately rapid permeability.	Good: water table at depth of 30 to 60 inches.
Thiokol: ThA, ThB, ThD, TkA, TkB.	Slight to moderate: moderate permeability.	Moderate to severe: slopes of 1 to 10 percent; moderate permeability.	Severe: high frost-heave potential; medium to low shear strength.	Severe: medium bearing strength; high frost-heave potential.	Slight	Slight to moderate: slopes of 0 to 10 percent.	Good
Timpanogos: TmA, TmB, TnA, ToB, ToC.	Moderate to severe: moderate permeability; water table at depth of 42 to 60 inches or more.	Moderate to severe: moderate permeability; slopes of 0 to 10 percent; water table at depth of 42 to 60 inches or more.	Severe: high frost-heave potential; water table at depth of 42 to 60 inches or more; medium to low shear strength.	Severe: high frost-heave potential; water table at depth of 42 to 60 inches or more.	Severe: water table at depth of 42 to 60 inches or more.	Moderate: water table at depth of 42 to 60 inches or more.	Good: water table at depth of 42 to 60 inches or more.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Good to poor: none to moderate salinity and alkali.	Unsuited to poor: ML or SM.	Poor: high frost-heave potential.	Moderate permeability; slopes of 1 to 10 percent.	Medium to low shear strength; medium to high piping hazard; good to poor compaction characteristics; low to medium compressibility.	Not applicable; well drained.	Moderate intake rate; erosion hazard; none to moderate salinity and alkali.	Undulating topography; high erosion hazard; unstable if sloping; slopes of 1 to 10 percent.
Fair to poor: water table at depth of 40 to 60 inches; high content of alkali.	Unsuited	Poor: high frost-heave potential; A-4, A-6, or A-7.	Slow to moderately slow permeability; slopes of 1 to 10 percent; water table at depth of 40 to 60 inches.	Medium to low shear strength; close compaction control essential; low to high piping hazard.	Slow to moderately slow permeability; fair internal drainage; limited outlets available; moderately well drained; water table at depth of 40 to 60 inches.	Slow to moderate intake rate; needs drainage; alkali affected; water table at depth of 40 to 60 inches.	Slow to moderately slow permeability; water table at a depth of 40 to 60 inches; medium to low shear strength.
Good to fair: moderately to very strongly alkaline; water table at depth of 30 to 40 inches.	Unsuited	Poor: high frost-heave potential; A-2, A-4, or A-6.	Moderate to moderately rapid permeability; slopes of 0 to 3 percent; water table at depth of 30 to 40 inches.	Medium to low; high piping hazard; close compaction control essential; medium to low shear strength.	Moderate to moderately rapid permeability; good internal drainage; somewhat poorly drained; water table at depth of 30 to 40 inches.	Moderate to rapid intake rate; low salinity; needs drainage in places; water table at depth of 30 to 40 inches.	Water table at a depth of 30 to 40 inches; medium to low shear strength.
Good to fair: strongly and very strongly alkaline; low to moderate salinity; water table at depth of 30 to 60 inches.	Unsuited for gravel. Poor for sand: 20 to 40 percent passes the No. 200 sieve.	Fair: moderate shear strength; moderate frost-heave potential; susceptible to piping; A-2.	Moderately rapid permeability; slopes of 0 to 1 percent; water table at depth of 30 to 60 inches.	Medium to high piping hazard; moderate compacted permeability; close compacted control essential; medium shear strength.	Moderately rapid permeability; low to moderate salinity; somewhat poorly drained; water table at depth of 30 to 60 inches.	Moderately rapid intake rate; low to moderate salinity; high pH; water table at depth of 30 to 60 inches; needs drainage and reclamation.	Moderately rapid permeability; water table at a depth of 30 to 60 inches.
Good	Unsuited: excessive fines.	Poor: high frost-heave potential; medium to low shear strength.	Moderate permeability; slopes of 0 to 10 percent.	Medium to low shear strength; low to high piping hazard; good to poor compaction characteristics.	Not applicable; well drained.	Moderate intake rate; erosion hazard; low organic-matter content; unstable if sloping; slopes of 0 to 10 percent.	Medium to low shear strength; low to high piping hazard; unstable if sloping; slopes of 0 to 10 percent.
Good: water table at depth of 42 to 60 inches or more.	Unsuited: excessive fines.	Poor: high frost-heave potential; medium to low shear strength.	Moderate permeability; slopes of 0 to 10 percent; water table at depth of 42 to 60 inches or more.	Medium to low shear strength; low to high piping hazard; good to poor compaction characteristics.	Moderate permeability; well or moderately well drained; water table at depth of 42 to 60 inches or more.	Moderate intake rate; some places need drainage; slopes of 0 to 10 percent; water table at depth of 42 to 60 inches or more.	Low to high piping hazard; medium to low shear strength; slopes of 0 to 10 percent.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills: Trench type	Sanitary landfills: Area type	Sanitary landfill cover materials
Uffens: UF	Severe: moderately slow permeability.	Slight to moderate: slopes of 0 to 6 percent.	Severe: high frost-heave potential; medium to low shear strength; moderate to high shrink-swell potential.	Severe: high frost-heave potential; moderate to high shrink-swell potential; medium bearing strength,	Slight	Slight	Poor: moderate to very high salinity.
Very stony land: VS. Not rated.							
Warm Springs: Wa	Severe: water table at depth of 24 to 40 inches.	Severe: moderate permeability; water table at depth of 24 to 40 inches.	Moderate: high frost-heave potential; water table at depth of 24 to 40 inches; somewhat poorly drained.	Severe: water table at depth of 24 to 40 inches.	Severe: water table at depth of 24 to 40 inches.	Severe: water table at depth of 24 to 40 inches.	Fair: water table at depth of 24 to 40 inches; low salinity.
Wasatch: WcC, WcE.	Slight to severe: pollution may be a problem; slopes of 3 to 25 percent.	Severe: rapid permeability; slopes of 3 to 25 percent; 25 to 80 percent gravel and cobblestones.	Slight to severe: slopes of 3 to 25 percent.	Slight to severe: slopes of 3 to 25 percent.	Severe: rapid permeability; slopes of 3 to 25 percent; 25 to 80 percent gravel, cobblestones, and stones.	Severe: rapid permeability; slopes of 3 to 25 percent.	Poor: 25 to 80 percent gravel, cobblestones, and stones; slopes of 3 to 25 percent.
Wasatch, gravelly subsoil variant: WdG, WeE.	Moderate to severe: slopes of 10 to 70 percent; pollution of ground water may be a hazard in places because of permeability in substratum.	Severe: rapid permeability; slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Moderate to severe: slopes of 10 to 70 percent.	Moderate to severe: slopes of 10 to 70 percent.	Severe: rapid permeability; slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Severe: rapid permeability; slopes of 10 to 70 percent.	Poor: 25 to 80 percent gravel and cobblestones; slopes of 10 to 70 percent.
*Wheelon: WhG, WmE. For Collinston soil in WmE, see Collinston series.	Moderate to severe: moderate permeability; slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent.	Severe: high frost-heave potential; slopes of 10 to 60 percent.	Severe: high frost-heave potential, slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent.	Severe to moderate: slopes of 10 to 60 percent.	Fair to poor: slopes of 10 to 60 percent.
Wheelon, shallow variant: WlG.	Severe: moderately slow permeability; slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches.	Severe: slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches; 20 to 80 percent gravel and cobblestones.	Severe: high frost-heave potential; slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches.	Severe: high frost-heave potential; slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches.	Severe: slopes of 20 to 60 percent; bedrock depth of 15 to 20 inches; 20 to 80 percent gravel and cobblestones.	Severe: slopes of 20 to 60 percent.	Poor: slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches; 20 to 80 percent gravel and cobblestones.
Windmill: WnB, WnD, WnE.	Slight to severe: slopes of 1 to 20 percent.	Severe: moderately rapid permeability; slopes of 1 to 20 percent; 20 to 50 percent gravel.	Slight to severe: slopes of 1 to 20 percent.	Slight to severe: slopes of 1 to 20 percent.	Severe: moderately rapid permeability; slopes of 1 to 20 percent.	Severe: moderately rapid permeability; slopes of 1 to 20 percent.	Fair to poor: 20 to 50 percent fine gravel; slopes of 1 to 20 percent.

See footnotes at end of table.

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: moderate to very high salinity.	Unsuited: excessive fines.	Poor: medium to low shear strength; moderate to high shrink-swell potential; high frost-heave potential.	Slopes of 0 to 6 percent.	Low to high piping hazard; low to medium shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Slow intake rate; moderate to very high salinity.	Not applicable.
Fair: water table at depth of 24 to 40 inches; low salinity.	Unsuited: excessive fines.	Fair to poor: water table at depth of 24 to 40 inches; moderate frost-heave potential.	Moderate permeability; water table at depth of 24 to 40 inches.	Low to high piping hazard; generally fair to poor compaction characteristics; low to medium compressibility; low to medium shear strength.	Moderate; somewhat poorly drained; water table at depth of 24 to 40 inches.	Moderate intake rate; low salinity; needs drainage and reclamation; water table at depth of 24 to 40 inches.	Not applicable.
Poor: slopes of 3 to 25 percent; 25 to 80 percent gravel and cobblestones.	Fair to poor: GM or GP-GM.	Poor to good: slopes of 3 to 25 percent.	Rapid permeability; slopes of 3 to 25 percent.	Low to high compacted permeability; low compressibility.	Not applicable; somewhat excessively drained.	Very rapid intake rate; low available moisture capacity; slopes of 3 to 25 percent; 25 to 80 percent gravel and cobblestones.	Rapid permeability; 25 to 80 percent gravel and cobblestones; slopes of 3 to 25 percent.
Poor: 25 to 80 percent gravel and cobblestones; slopes of 10 to 70 percent.	Fair to poor: GM or GP-GM.	Generally fair to poor: slopes of 10 to 70 percent.	Rapid permeability; slopes of 10 to 70 percent.	Low to high compacted permeability; low compressibility.	Not applicable; excessively drained.	Very rapid intake rate; low available moisture capacity; slopes of 10 to 70 percent; 25 to 80 percent gravel and cobblestones.	Not applicable.
Fair to poor: slopes of 10 to 60 percent.	Unsuited: excessive fines.	Poor: high frost-heave potential; slopes of 10 to 60 percent; A-4.	Moderate to slow permeability; slopes of 10 to 60 percent.	Low to high piping hazard; low to medium shear strength; good to poor compaction characteristics.	Not applicable; well drained.	Slow intake rate; high erosion hazard; well suited to sprinkler irrigation.	Undulating topography; erosion hazard; unstable if sloping; slopes of 10 to 60 percent.
Poor: slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches; 20 to 80 percent gravel and cobblestones.	Poor to unsuited; GM or ML.	Poor: high frost-heave potential; slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches.	Slopes of 20 to 60 percent; bedrock at depth of 15 to 20 inches.	High to low shear strength; low to medium compressibility; low to high piping hazard; good to poor compaction characteristics.	Not applicable; well drained.	Not applicable.	Not applicable.
Poor: 20 to 50 percent gravel; slopes of 1 to 20 percent.	Poor to fair: excessive fines.	Good to fair: slopes of 1 to 20 percent.	Moderately rapid permeability; slopes of 1 to 20 percent.	High to medium shear strength; good to fair compaction characteristics; low to medium compressibility; low to medium compacted permeability; medium to high piping hazard.	Not applicable; well drained.	Rapid intake rate; low available moisture capacity; slopes of 1 to 20 percent.	Moderately rapid permeability; 20 to 50 percent gravel.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—						Suitability as a source of—
	Septic tank absorption fields [1]	Sewage lagoons	Local roads and streets	Dwellings with basements	Sanitary landfills		Sanitary landfill cover materials
					Trench type	Area type	
Woods Cross: Wo, Wr.	Severe: slow permeability; water table at depth of 20 to 30 inches.	Severe: water table at depth of 20 to 30 inches.	Severe: high frost-heave potential; high shrink-swell potential; water table at depth of 20 to 30 inches; poorly drained.	Severe: high frost-heave potential; high shrink-swell potential; water table at depth of 20 to 30 inches.	Severe: water table at depth of 20 to 30 inches.	Severe: water table at depth of 20 to 30 inches.	Poor: water table at depth of 20 to 30 inches; poorly drained; Wr has moderate salinity.
*Yeates Hollow: YHE, YHG, YRE. For Goring soil in YRE, see Goring series.	Severe: slow permeability; slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent; bedrock at depth of 42 inches; 20 to 85 percent cobblestones and stones.	Severe: high shrink-swell potential; slopes of 10 to 60 percent; bedrock at depth of 42 inches or more.	Severe: slopes of 10 to 60 percent; high shrink-swell potential.	Severe: slopes of 10 to 60 percent; bedrock at depth of 42 inches or more; 20 to 85 percent cobblestones and stones.	Generally severe: slopes of 10 to 60 percent.	Poor: slopes of 10 to 60 percent; 20 to 85 percent cobblestones and stones.

[1] Limitations because of water table or restrictive layer are based on tile depth of 2 feet in the soil. If septic tank is from a basement, rate one class lower than shown if a high watertable or restrictive layer is present.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Dwellings, as rated in table 5, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 5 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, every site should be investigated before it is selected.

Suitability of a soil as cover material for sanitary landfill is based on properties that reflect workability and ease of digging, moving, and spreading over the refuse daily during both wet and dry periods. Slope, texture, rock fragments, wetness, and thickness of soil material are important properties to consider.

The soils are rated as good, fair, or poor. The best soils rated good are friable sandy loam, loam, silt loam, or sandy clay loam that is more than 40 inches thick and less than 15 percent rock fragments. Slopes are less than 8 percent, and the soils are not poorly drained. The soils rated poor are silty clay, clay, muck, peat, or sand, are less than 20 inches deep, have more than 35 percent rock fragments, have slopes of 15 percent or more, are poorly drained, or have a combination of these properties. Soils rated fair have properties that are intermediate between those of the soils rated good and poor.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 5 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment

properties of the soils—Continued

Suitability as a source of—Continued			Soil features affecting—				
Topsoil	Sand and gravel	Road fill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: none to moderate salinity; water table at depth of 20 to 30 inches; poorly drained; silty clay loam.	Unsuited: excessive fines.	Poor: water table at depth of 20 to 30 inches; high frost-heave potential; high shrink-swell potential.	Water table at depth of 20 to 30 inches.	Low to medium shear strength; poor to good compaction characteristics; low to high piping hazard.	Slow permeability; none to moderate salinity; poorly drained; water table at depth of 20 to 30 inches.	Slow intake rate; high available moisture capacity; difficult to till; may be moderately saline in places; water table at depth of 20 to 30 inches.	Not applicable.
Poor: 20 to 85 percent cobblestones and stones; slopes of 10 to 60 percent.	Unsuited: excessive fines.	Poor: 20 to 85 percent cobblestones and stones; slopes of 10 to 60 percent.	Slopes of 10 to 60 percent; bedrock at depth of 42 inches or more.	Medium to low shear strength; good to poor compaction characteristics; 20 to 85 percent cobblestones and stones.	Not applicable; well drained.	Not applicable.	Not applicable.

[1] Pollution may be a hazard in places because of permeability in substratum.

that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material in borrow areas.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Soil test data

Table 6 contains engineering test data for some of the major soil series in Box Elder County, Eastern Part. These tests were made by Utah State University to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Soils for Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 7 the soils of Box Elder County, Eastern Part, are rated according to limitations that affect their suitability for playgrounds, camp areas, picnic areas, and paths and trails.

In table 7 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A rating of *slight* means

TABLE 6.—*Engineering*

[Tests made by Utah

Soil name and location	Parent material	Depth
		Inches
Fielding silt loam: 850 feet west, 800 feet north from S¼ corner of sec. 31, T. 13 N., R. 2 W. (modal).	Mixed lake sediments (limestone, sandstone, quartzite).	0–15
		15–34
		34–52
		52–66
Fridlo silt loam: 1,050 feet west, 400 feet north from SE. corner of sec. 7, T. 12 N., R. 5 W. (modal).	Mixed lake sediments (limestone, sandstone, quartzite).	0–9
		9–21
		21–43
		43–60
Hansel silt loam: 750 feet west, 800 feet north from E¼ corner of sec. 30, T. 13 N., R. 5 W. (modal).	Mixed lake sediments (limestone, sandstone, quartzite).	0–10
		10–18
		18–33
		33–62
Honeyville silty clay loam: 2,400 feet east, 1,600 feet north from SW. corner of sec. 22, T. 11 N., R. 3 W. (modal).	Mixed lake sediments (limestone, sandstone, quartzite).	0–10
		10–24
		24–43
		43–60
Hupp gravelly silt loam: 2,100 feet east, 1,300 feet north from SW. corner of sec. 32, T. 13 N., R. 6 W. (modal).	Very gravelly or cobbly mixed alluvium (limestone, sandstone, quartzite).	0–18
		18–32
		32–51
Kearns silt loam: 660 feet west, 660 feet south from the N¼ corner, sec. 31, T. 12 N., R. 5 W. (modal).	Mixed lake sediments (limestone, sandstone, quartzite).	0–15
		15–39
		39–76
Stingal loam: 1,800 feet east, 175 feet south from NW. corner of sec. 4, T. 10 N., R. 7 W. (modal).	Mixed lake sediments (limestone, sandstone, quartzite).	0–6
		6–25
		25–56
		56–74
Thiokol silt loam: 1,750 feet west, 1,500 feet north from SE. corner of sec. 13, T. 13 N., R. 6 W. (modal).	Mixed lake sediments (limestone, sandstone, quartzite).	0–9
		9–20
		20–60

[1] Mechanical analysis according to AASHO Designation: T 88–57 (*1*). Results by this procedure may differ from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[2] Based on AASHO Designation M 145–49 (*1*).

[3] Based on the Unified Soil Classification System, Technical Memorandum No. 3–357, v. 1, Corps of Engineers (*14*).

test data

State University]

Mechanical analysis[1]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—					Percentage smaller than—						AASHO[2]	Unified[3]
3-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
100	--------	98	95	86	72	45	25	18	35	10	A-4(8)	OL
100	--------	98	96	85	70	41	20	13	32	2	A-4(8)	ML
100	--------	91	86	82	79	61	25	15	36	8	A-4(8)	ML
100	--------	--------	--------	94	90	69	33	20	42	18	A-7-6(11)	CL
100	--------	--------	--------	93	85	59	26	16	34	13	A-6(9)	CL
100	--------	--------	--------	93	85	62	34	21	28	10	A-4(8)	CL
100	--------	--------	99	89	82	59	27	16	28	6	A-4(8)	ML-CL
100	--------	--------	--------	92	89	79	48	24	40	15	A-6(10)	CL or ML
100	--------	--------	96	85	79	61	33	21	30	10	A-4(8)	CL
100	--------	--------	100	97	90	74	46	28	39	28	A-6(15)	CL
100	--------	--------	98	91	84	63	33	20	34	8	A-4(8)	ML
100	--------	--------	99	95	86	63	35	23	35	8	A-4(8)	ML
100	--------	99	98	94	93	84	55	41	37	16	A-6(10)	CL
100	--------	100	98	94	94	86	58	43	34	13	A-6(9)	CL
100	--------	99	97	94	--------	90	65	45	34	10	A-4(8)	CL or ML
100	--------	99	97	96	--------	91	65	44	40	22	A-6(13)	CL
100	[4] 40	37	36	31	26	14	6	3	33	8	A-2-4(0)	GM
100	[5] 69	67	65	56	49	26	14	9	29	9	A-4(4)	CL
100	[6] 69	67	66	57	47	28	14	9	27	6	A-4(4)	ML-CL
100	--------	--------	--------	93	--------	--------	--------	--------	25	5	A-4(8)	ML-CL
100	--------	--------	--------	91	--------	--------	--------	--------	26	4	A-4(8)	ML-CL
100	--------	--------	98	74	--------	--------	--------	--------	20	0	A-4(8)	ML
100	--------	100	99	72	56	34	19	12	26	2	A-4(8)	ML
100	--------	98	96	59	45	28	16	12	19	3	A-4(5)	ML
100	--------	100	99	70	50	23	13	10	31	[7] NP	A-4(7)	ML
100	--------	--------	100	53	34	15	8	6	--------	NP	A-4(4)	ML
100	--------	--------	--------	97	86	54	29	19	29	5	A-4(8)	ML
100	--------	--------	--------	97	93	63	32	21	33	10	A-4(8)	CL or ML
100	--------	--------	99	94	83	41	13	6	38	7	A-4(8)	ML

[4] 46 percent passed the 3/8-inch sieve, 58 percent passed the 3/4-inch sieve, 67 percent passed the 1-inch sieve, 81 percent passed the 1½-inch sieve, and 91 percent passed the 2-inch sieve.

[5] 74 percent passed the 3/8-inch sieve, 81 percent passed the 3/4-inch sieve, 87 percent passed the 1-inch sieve, 96 percent passed the 1½-inch sieve, and 97 percent passed the 2-inch sieve.

[6] 72 percent passed the 3/8-inch sieve, 79 percent passed the 3/4-inch sieve, 84 percent passed the 1-inch sieve, 91 percent passed the 1½-inch sieve, and 95 percent passed the 2-inch sieve.

[7] NP means nonplastic.

TABLE 7.—*Soil interpretations for recreation*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
Abela: ABE, AEE	Severe: coarse fragments; slope.	Moderate to severe: coarse fragments; slope.	Moderate to severe: coarse fragments; slope.	Moderate to severe: coarse fragments.
*Agassiz: AGG. For Picayune soil, see Picayune series.	Severe: slope; rock at a depth of 14 to 19 inches; coarse fragments.	Severe: slope; coarse fragments.	Severe: slope; coarse fragments.	Severe: slope; coarse fragments.
Airport:[1] Ao, Ap, Ar	Moderate: water table at a depth of 26 to 40 inches; flooding; slow permeability.	Moderate: water table at a depth of 26 to 40 inches; flooding; slow permeability.	Moderate: water table at a depth of 26 to 40 inches; flooding.	Moderate: water table at a depth of 26 to 40 inches; flooding.
Anty:[2]				
AtB	Moderate: slope	Slight	Slight	Slight.
AtD	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Arave: AV[1]	Severe: water table at a depth of 12 to 30 inches; flooding.	Severe: water table at a depth of 12 to 30 inches; flooding.	Severe: water table at a depth of 12 to 30 inches; flooding.	Severe: water table at a depth of 12 to 30 inches; flooding.
Bickmore: BCG	Severe: slope; coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
Bingham:				
BdB	Moderate: slope	Slight	Slight	Slight.
BeB, BeD	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
*Blue Star:				
BgE	Severe: slope; coarse fragments.	Moderate to severe: slope; coarse fragments.	Moderate to severe: slope; coarse fragments.	Moderate: coarse fragments.
BLG. For Blue Star, gravelly subsoil variant, in BLG, see Blue Star, gravelly subsoil variant.	Severe: slope; coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
Blue Star, gravelly subsoil variant: BhD.	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
Borrow pits: Bp. Not rated.				
Bram: BR[1,2]	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight.
*Broad: BSE, BSG, BTG, BUG, BVG. For Manila soil in BTG, Middle soil in BUG, and Smarts soil in BVG, see those series.	Severe: slope; coarse fragments.	Severe: slope; coarse fragments.	Severe: slope; coarse fragments.	Severe: slope; coarse fragments.
Collett: Co	Moderate: slow permeability; clayey.	Moderate: slow permeability; clayey.	Moderate: clayey	Moderate: clayey.
*Collinston: CwD[2]. For Wheelon soil, see Wheelon series.	Severe: slope	Moderate: slope	Moderate: slope	Slight.

See footnotes at end of table.

TABLE 7.—*Soil interpretations for recreation*—Continued

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
Cudahy: Cy	Moderate: water table at a depth of 20 to 30 inches; depth to hardpan.	Moderate: water table at a depth of 20 to 30 inches.	Moderate: water table at a depth of 20 to 30 inches.	Moderate: water table at a depth of 20 to 30 inches.
Dagor: DaB [2]	Moderate: slope; coarse fragments.	Slight	Slight	Slight.
DeJarnet: DgB, DgD	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
Draper: DrA	Slight	Slight	Slight	Slight.
Drum: DU [1,2]	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight.
Eccles: [2]				
EcA	Slight	Slight	Slight	Slight.
EcB	Moderate: slope	Slight	Slight	Slight.
EcD	Severe: slope	Moderate: slope	Severe: slope	Slight.
Eccles, sandy variant: EIB.	Moderate: slope; sandy	Moderate: sandy	Moderate: sandy	Moderate: sandy.
*Elzinga: EMF, ENF. For Agassiz soil in EMF and Maughan soil in ENF, see those series.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Etil: ETB [1]	Moderate: sandy; slope	Moderate: sandy	Moderate: sandy	Moderate: sandy.
Fielding: [2] Fd, Fe	Slight	Slight	Slight	Slight.
Forsgren:				
FgB	Moderate: slope; slow permeability.	Moderate: slow permeability; slope.	Slight	Slight.
FgD [2]	Severe: slope	Moderate: slow permeability; slope.	Moderate: slope	Slight.
FgE	Severe: slope	Moderate to severe: slope.	Moderate to severe: slope.	Slight to moderate: slope.
*Foxol: FHG, FRG. For Elzinga soil in FHG, see Elzinga series; Rock outcrop in FRG not rated.	Severe: slope; rock at a depth of 14 to 20 inches; coarse fragments.	Severe: slope; coarse fragments.	Severe: slope; coarse fragments.	Severe: slope; coarse fragments.
Francis: FsB	Moderate: sandy	Moderate: sandy	Moderate: sandy	Moderate: sandy.
Fresh water marsh: FT. Not rated.				
Fridlo: Fu, Fv [1,2]	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Slight	Slight.
*Gemson:				
GcD	Severe: slope	Moderate: slope; slow permeability.	Moderate: slope	Slight.
GcE, GEE. Rock outcrop in GEE not rated.	Severe: slope	Moderate to severe: slope.	Moderate to severe: slope.	Slight to moderate: slope.
Gooch: Gh [1,2]	Severe: water table at a depth of less than 20 inches; flooding.	Severe: water table at a depth of less than 20 inches; flooding.	Severe: water table at a depth of less than 20 inches; flooding.	Severe: water table at a depth of less than 20 inches; flooding.

See footnotes at end of table.

TABLE 7.—*Soil interpretations for recreation*—Continued

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
*Goring: GLE. For Yeates Hollow soil, see Yeates Hollow series.	Severe: slope.	Severe: slope.	Severe: slope.	Slight to moderate: slope.
Goring, brown subsoil variant: GM.	Moderate: slow permeability.	Moderate: slow permeability.	Slight.	Slight.
Gravel pits: Gp. Not rated.				
Greenson: Gr, Gs [1, 2]	Moderate: slow to moderate permeability.	Moderate: slow to moderate permeability.	Slight.	Slight.
Gullied land: GU. Not rated.				
Hansel:[1, 2]				
HaA, HaB	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight.	Slight.
HaD	Severe: slope.	Moderate: moderately slow permeability.	Moderate: slope.	Slight.
Harding: HD [1, 2]	Moderate: slow permeability.	Moderate: slow permeability.	Slight.	Slight.
*Hendricks:[2]				
HeB	Moderate: slope; moderately slow permeability.	Moderate: moderately slow permeability.	Slight.	Slight.
HeD, HkD	Severe: slope.	Moderate: moderately slow permeability.	Moderate: slope.	Slight.
HeE. For Kearns soil in HkD, see Kearns series.	Severe: slope.	Moderate to severe: slope.	Moderate to severe: slope.	Slight to moderate: slope.
Honeyville: Ho	Moderate: clayey.	Moderate: clayey.	Moderate: clayey.	Moderate: clayey.
Hupp:				
HpB, HpD	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
HuC	Moderate: slope.	Slight.	Slight.	Slight.
HuD	Severe: slope.	Moderate: slope.	Moderate: slope.	Slight.
James Canyon: JaA	Slight.	Slight.	Slight.	Slight.
Kapod: KaE	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments.
*Kearns:				
KeB, KeC [2]	Moderate: slope.	Slight.	Slight.	Slight.
KeD, KgD	Severe: slope.	Moderate: slope.	Moderate: slope.	Slight.
KeE. For Stingal soil in KgD, see Stingal series.	Severe: slope.	Moderate to severe: slope.	Severe: slope.	Slight to moderate: slope.
Kearns, high lime variant: KhE.[2]	Severe: slope.	Moderate to severe: slope.	Moderate to severe: slope.	Slight to moderate: slope.
Kidman:				
KlA, KmA	Slight.	Slight.	Slight.	Slight.
KlB, KmB	Moderate: slope.	Slight.	Slight.	Slight.
KmD	Severe: slope.	Moderate: slope.	Moderate: slope.	Slight.
KmE	Severe: slope.	Moderate to severe: slope.	Moderate to severe: slope.	Slight to moderate: slope.

See footnotes at end of table.

TABLE 7.—*Soil interpretations for recreation*—Continued

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
Kilburn:				
KnC, KnD, KnE, KoB.	Severe: coarse fragments.	Moderate to severe: coarse fragments.	Moderate to severe: coarse fragments.	Moderate to severe: coarse fragments.
KnF	Severe: coarse fragments.	Severe: slope	Severe: slope	Moderate to severe: coarse fragments.
KnG	Severe: coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
Kirkham: Kr [1,2]	Moderate: water table at a depth of 20 to 50 inches; moderately slow permeability; flooding.	Moderate: water table at a depth of 20 to 50 inches; moderately slow permeability.	Slight	Slight.
Lakeshore: LA [1]	Severe: water table at the surface; flooding.	Severe: water table at the surface; flooding.	Severe: water table at the surface; flooding.	Severe: water table at the surface; flooding.
*Lasil: [1,2] Lc, Ld, Lr. For Airport soil in Lr, see Airport series.	Moderate: water table at a depth of 20 to 40 inches.	Moderate: water table at a depth of 20 to 40 inches.	Slight	Slight.
Lewiston: Ls	Slight	Slight	Slight	Slight.
Logan: Lt [1]	Moderate to severe: water table at a depth of 15 to 60 inches.	Moderate to severe: water table at a depth of 15 to 60 inches.	Moderate to severe: water table at a depth of 15 to 60 inches.	Moderate to severe: water table at a depth of 15 to 60 inches.
*Lucky Star: LUE [2]. For Elzinga soil, see Elzinga series.	Severe: slope; coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
Magna: Ma [1]	Severe: water table at a depth of 18 to 30 inches; very slow permeability.	Severe: water table at a depth of 18 to 30 inches; very slow permeability.	Moderate: water table at a depth of 18 to 30 inches.	Moderate: water table at a depth of 18 to 30 inches.
*Manila:				
MbC	Severe: slope	Moderate: slope	Moderate: slope	Slight.
MbE	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
MCG, MDG. For Smarts soil in MDG, see Smarts series.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Martini: Me [2]	Moderate: flooding	Moderate: flooding	Slight	Slight.
Maughan [2]. Mapped only in a complex with Elzinga series.	Severe: coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
*Mellor: [1,2] MFB, MGB. For Thiokol soil in MGB, see Thiokol series.	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Mendon:				
MhB	Moderate: moderately slow to moderate permeability; slope.	Moderate: moderately slow to moderate permeability.	Slight	Slight.
MhD	Moderate: moderately slow to moderate permeability; slope.	Moderate: moderately slow to moderate permeability.	Moderate: slope	Slight.

See footnotes at end of table.

TABLE 7.—*Soil interpretations for recreation*—Continued

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
*Middle:				
MIE, MKE	Severe: coarse fragments; slope.	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.
MIG, MJG, MKG. For Broad soil in MJG, see Broad series; Rock outcrop in MKE and MKG not rated.	Severe: coarse fragments; slope.	Severe: slope	Severe: slope	Severe: slope.
Millville:[2] MIA, MIB, MmB.	Slight	Slight	Slight	Slight.
Munk: MuE	Severe: coarse fragments; slope.	Moderate to severe: slope; coarse fragments.	Moderate to severe: slope; coarse fragments.	Moderate: coarse fragments.
Obray: OBE	Severe: clayey	Severe: clayey	Severe: clayey	Severe: clayey.
Palisade:[2]				
PAB	Moderate: slope	Slight	Slight	Slight.
PAD	Severe: slope	Moderate: slope	Moderate: slope	Slight.
*Parleys:				
PbA, PdA, PeA	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight.
PeB	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight.
PeD	Severe: slope	Moderate: moderately slow permeability.	Moderate: slope	Slight.
PeE, PmE	Severe: slope	Moderate to severe: slope.	Moderate to severe: slope.	Slight to moderate: slope.
PIA	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Moderate: clayey	Moderate: slope.
PmD, PnD. For Munk soil in PmD and PmE and Pomat soil in PnD, see those series.	Severe: slope	Moderate: moderately slow permeability.	Moderate: slope	Slight.
Pass Canyon: POE. Rock outcrop in this mapping unit not rated.	Severe: slope; rock at a depth of 14 to 20 inches.	Moderate to severe: slope.	Moderate to severe: slope.	Slight to moderate: slope.
Payson: Pr[1,2]	Severe: slow permeability.	Severe: slow permeability.	Slight	Slight.
Peteetneet, moderately deep variant: Ps.	Severe: organic soil	Severe: organic soil	Severe: organic soil	Severe: organic soil.
Picayune. Mapped only in an association with Agassiz series.	Severe: slope; coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
Placeritos: PT[1,2]	Moderate: water table at a depth of 20 to 40 inches; flooding.	Moderate: water table at a depth of 20 to 40 inches; flooding.	Moderate: flooding	Moderate: flooding.
Playas: PU. Not rated.				
Pogal: PVC[1,2]	Slight	Slight	Slight	Slight.

See footnotes at end of table.

TABLE 7.—*Soil interpretations for recreation*—Continued

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
*Pomat:[2]				
PwD	Severe: slope	Moderate: slope	Moderate: slope	Slight.
PwE, PxE, PyE	Severe: slope	Moderate to severe: slope.	Moderate to severe: slope.	Moderate: slope.
PwG2	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
For Kearns soil in PxE and Parleys soil in PyE, see those series.				
Promo. Mapped only in an association with Sandall series.	Severe: rock at a depth of 12 to 20 inches; coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.
Red Rock:[2]				
RdA, ReA	Slight	Slight	Slight	Slight.
ReB	Moderate: slope	Slight	Slight	Slight.
Refuge: Rf[1, 2]	Moderate: water table at a depth of 20 to 40 inches; flooding.	Moderate: water table at a depth of 20 to 40 inches; flooding.	Slight	Slight.
*Richmond: RMG2. For Middle soil, see Middle series.	Severe: rock at a depth of 11 to 19 inches; coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.
*Ridd: RrE, RrG. Rock outcrop in these mapping units not rated.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments.
Rock land: RS. Not rated.				
Rock outcrop: RT. Not rated.				
Roshe Springs: Ru[2]	Severe: water table at a depth of 0 to 20 inches; flooding.	Severe: water table at a depth of 0 to 20 inches; flooding.	Severe: water table at a depth of 0 to 20 inches; flooding.	Severe: water table at a depth of 0 to 20 inches; flooding.
Rough broken land: Rv. Not rated.				
*Rozlee: RWG. Rock outcrop in this mapping unit not rated.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.
*Saltair:[1, 2] SA, SB, SC, Sd. For Logan soil in SC and Refuge soil in Sd, see those series; Fresh water marsh in SB not rated.	Severe: water table at a depth of 0 to 20 inches; flooding.	Severe: water table at a depth of 0 to 20 inches; flooding.	Severe: water table at a depth of 0 to 20 inches; flooding.	Severe: water table at a depth of 0 to 20 inches; flooding.

See footnotes at end of table.

TABLE 7.—*Soil interpretations for recreation*—Continued

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
*Sandall: SEE, SEG, SFG, SGG, SHE, SJG. For Broad soil in SFG, Promo soil in SGG, and Rozlee soil in SJG, see those series; Rock outcrop in SHE not rated.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments; slope.	Severe: coarse fragments.
Sanpete:				
SkE, SlE	Severe: coarse fragments.	Severe: slope	Severe: slope	Moderate to severe: coarse fragments; slope.
SlB, SlD	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
SlG	Severe: coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
*Saxby: SMB, SN. For Thiokol soil in SMB, see Thiokol series; Very stony land in SN not rated.	Severe: rock at a depth of 17 to 20 inches; coarse fragments.	Severe: coarse fragments.	Severe: coarse fragments.	Severe: coarse fragments.
Sheeprock:				
SoD	Severe: coarse fragments; slope.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
SpF3	Severe: coarse fragments; slope.	Severe: slope	Severe: slope	Moderate to severe: coarse fragments; slope.
Smarts: SQG	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Snowville: SrE	Severe: rock at a depth of 14 to 20 inches; coarse fragments; slope.	Moderate to severe: slope.	Moderate to severe: slope.	Moderate: coarse fragments.
*Sterling:				
SsB, SsD	Severe: coarse fragments; slope.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
SsF, StE	Severe: coarse fragments; slope.	Severe: slope	Severe: slope	Moderate to severe: slope.
SsG	Severe: coarse fragments; slope.	Severe: slope	Severe: slope	Severe: slope.
SuE. For Parleys soil in SuE, see Parleys series.	Severe: coarse fragments; slope.	Moderate to severe: slope.	Moderate to severe: slope.	Moderate: coarse fragments.
Stingal: [1]				
SvB	Moderate: slope	Slight	Slight	Slight.
SvD	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Stokes: Sw [1, 2]	Moderate: slow to moderately slow permeability.	Moderate: slow to moderately slow permeability.	Slight	Slight.
Stony alluvial land: Sx. Not rated.				
Sunset: Sy [1, 2]	Slight	Slight	Slight	Slight.

See footnotes at end of table.

TABLE 7.—*Soil interpretations for recreation*—Continued

Soil series and map symbols	Degree and kind of limitations for—			
	Playgrounds	Camp areas	Picnic areas	Paths and trails
Syracuse: Sz [1, 2]	Slight	Slight	Slight	Slight.
Thiokol: [2]				
ThA, TkA	Slight	Slight	Slight	Slight.
ThB, TkB	Moderate: slope	Slight	Slight	Slight.
ThD	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Timpanogos: [2]				
TmA, TnA	Slight	Slight	Slight	Slight.
TmB, ToB	Moderate: slope	Slight	Slight	Slight.
ToC	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Uffens: UF [1, 2]	Slight	Slight	Slight	Slight.
Very stony land: VS. Not rated.				
Warm Springs: Wa	Moderate: water table at a depth of 24 to 40 inches.	Moderate: water table at a depth of 24 to 40 inches.	Slight	Slight.
Wasatch:				
WcC	Severe: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
WcE	Severe: coarse fragments.	Severe: slope	Severe: slope	Moderate: coarse fragments.
Wasatch, gravelly subsoil variant:				
WdG	Severe: coarse fragments; slope.	Severe: slope	Severe: slope	Severe: slope.
WeE	Severe: coarse fragments; slope.	Severe: slope	Severe: slope	Moderate: coarse fragments.
*Wheelon:				
WhG	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
WmE	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
For Collinston soil in WmE, see Collinston series.				
Wheelon, shallow variant: WIG.	Severe: rock at a depth of 15 to 20 inches; coarse fragments; slope.	Severe: slope	Severe: slope	Severe: slopes
Windmill:				
WnB, WnD	Severe: gravel	Moderate: coarse fragments.	Moderate: coarse fragments.	Moderate: coarse fragments.
WnE	Severe: gravel	Severe: slope	Severe: slope	Moderate: coarse fragments.
Woods Cross: Wo, Wr.[1]	Moderate: slow permeability; clayey.	Moderate: slow permeability; clayey.	Moderate: clayey	Moderate: clayey.
*Yeates Hollow:				
YHE	Severe: coarse fragments.	Severe: slope	Severe: slope	Slight to moderate: slope.
YHG, YRE	Severe: coarse fragments.	Severe: slope	Severe: slope	Severe: slope.
For Goring soil in YRE, see Goring series.				

[1] Establishing and maintaining an adequate vegetative cover is a problem on saline-alkali soils.
[2] Dust may be a problem.

that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A rating of *moderate* means that limitations can be overcome or modified by planning, by design, or by special maintenance. A rating of *severe* means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have slopes or stoniness that greatly increase cost of leveling sites or of building access roads.

Paths and trails are used for local and cross country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained; are firm when wet but not dusty when dry; are flooded not more than once during the season of use; have slopes of less than 15 percent; and have few or no rocks or stones on the surface.

Formation and Classification of the Soils[6]

This section describes how the factors of soil formation have affected the development of soils in Box Elder County, Eastern Part. It also places the soil series represented in this survey area in some categories of the current system of soil classification.

Formation of Soils

Soils are formed by forces of the environment acting upon soil material deposited or accumulated by various geologic agents. The characteristics of a soil at any particular place on the earth depend upon (1) the chemical and mineralogical composition of the parent material; (2) the climate under which the parent material has existed since accumulation; (3) the plant and animal life on and in the soil, including man himself; (4) the relief or lay of the land; and (5) the length of time the parent material has been subjected to active weathering forces.

The relative importance of each factor differs from place to place, but generally the interaction of all factors determines the kind of soil that forms in any given place.

Soil development is reflected in the kinds and distinctness of horizons and their arrangement in the profile. The horizons most important in this survey area are (1) accumulation of organic matter in the surface layer of some soils, (2) clay enrichment in the subsoil of some soils, (3) carbonate accumulation and cementation of carbonates, (4) absence of free carbonates in the soils, and (5) depth to bedrock.

Parent material

Parent material is the weathered rock or unconsolidated materials in which soils form. The hardness, grain size, and porosity of the parent materials and the content of weatherable minerals greatly influence the formation of soils. In Box Elder County, Eastern Part, the parent material is of three main kinds—mixed lake sediments; recent post-Bonneville alluvium; and older alluvium, colluvium, and residuum.

The lake sediment parent materials came dominantly from limestone, quartzite, dolomite, and conglomerate rocks of Tertiary to Paleozoic ages. Materials from these rock sources were carried into the valley and deposited by the Bear River, Malad River, and other streams. The water movement of old Lake Bonneville subsequently sorted some of these materials and formed the lake terraces as the lake receded. In the sorting of materials, the coarser sediments were deposited near the mouths of canyons or in deltas. The finer particles were carried further into the lake. As the lake receded, streams continued to deposit material in it. Thus, some coarser materials are on the lower lake terraces.

The most noticeable characteristic of parent material in the soils that formed in lake sediments is the variation in texture. Lamination and fine stratification occur particularly in the C horizons. The relative percentage of the various sized particles—sand, silt, clay, and coarser fragments—that were dominant characteristics of the parent materials are prominent in the soils. Textures range from sand to clay, but are dominantly silt loam, silty clay loam, silty clay, loam, or clay loam high in content of silt. The silt content generally ranges from 50 to 75 percent in these lake sediment soils.

The Collett and Honeyville soils are examples of soils that formed in the finer textured lake sediments. These soils are mainly silty clay or heavy silty clay loam with about 37 to 44 percent clay and 55 to 60 percent silt and only 1 to 3 percent sand. These soils occur mainly on the low terraces and lack clay-enriched B horizons.

The Parleys, Hansel, and Mellor soils formed mainly on high, intermediate, and low terraces, respectively. These are examples of soils that formed in the moderately fine textured lake sediments. These soils are mainly silty clay loam with about 55 to 62 percent silt, 28 to 35 percent clay, and about 10 percent sand.

The Kearns, Fielding, and Thiokol soils are examples of soils that formed in medium-textured lake sediments on lower terraces. These soils are mainly silt loam with 56 to 64 percent silt, 18 to 28 percent clay, and about 15 percent

[6] AUSTIN ERICKSON, soil correlator, prepared this section.

sand. The Timpanogos soils formed in similar sediments, mainly on higher terraces, and are slightly more sandy.

The Kidman, Palisade, and Stingal soils are examples of soils that formed in the moderately coarse textured sediments on the intermediate and high terraces. These soils are mainly fine sandy loam, very fine sandy loam, and light loam with about 8 to 18 percent clay, 45 to 55 percent sand, and 30 to 45 percent silt. The Bram soils formed in similar sediments on lower terraces and have a higher content of silt.

The Etil soils formed in oolitic sands deposited on the beach areas of Great Salt Lake, probably by wave action. These soils are 75 percent or more calcium carbonate.

The Hupp, Sterling, and Windmill soils are examples of soils that formed in gravelly and cobbly sediment as deltas, offshore bars, or fans deposited near the mouths of canyons. These and other soils in similar settings have more than 35 percent gravel, cobblestones, and stone-sized fragments in their profiles.

Another influence of parent material is carbonate content. Most of the soils that formed in the mixed lake sediments are calcareous in some part. The younger soils on lower terraces are mainly calcareous throughout. Generally, the older soils on higher terraces are noncalcareous in the upper horizons but have developed layers of strong lime accumulation in the lower part. The depth of carbonate leaching is related to texture and precipitation.

Salts more soluble than carbonates are also characteristic of the lake sediments. Most of the soils that are not gravelly and cobbly on lake terraces have an exchangeable sodium content of 7 percent or more in the C horizons. This sodium content generally increases with decrease in elevation. The Harding, Mellor, and Bram soils on the lower lake terraces and lake plains have 40 to 70 percent exchangeable sodium in the C horizons.

Some of the lake-deposited sediments have been subsequently moved and sorted or otherwise altered by wind or flooding. The Pogal soils formed in materials that were piled up by wind action after the lake receded. These soils are calcareous throughout and contain about 60 percent silt and 40 to 75 percent exchangeable sodium in the C horizons.

The Collinston, Mendon, and Wheelon soils formed in materials of the Salt Lake geological formation that are rather high in volcanic ash content. This characteristic is shown by the high percentage of exchangeable potassium in these soils. Some of the Salt Lake formation materials were moved and sorted by Lake Bonneville.

The recent post-Bonneville alluvium deposits are mainly on the flood plains and lower river terraces of the Malad and Bear Rivers. Some were deposited by smaller streams and flash floods from adjacent hillsides or higher terraces. These deposits are generally stratified in texture, but are dominantly calcareous sandy loam to silty clay loam. Subsequently, the soils that formed in these materials are calcareous and stratified. Because of their position, most of these soils are affected by the water table and range from moderately well drained to poorly drained. The Placeritos, Kirkham, Sunset, and Martini soils are examples of soils that formed in these materials.

The Kirkham soils formed in silty clay loam sediments. The Placeritos soils are highly stratified sandy loam to silty clay loam but are mainly light loam. The Sunset and Martini soils are mainly loam and sandy loam, respectively.

The older alluvial and colluvial deposits and the residual parent materials are mainly in four areas: (1) the Clarkston Mountains in the northeast corner of the survey area; (2) the Wasatch and Wellsville Mountains along the east boundary of the survey area; (3) the West Mountains and Blue Spring Hills that join each other and extend from the north survey boundary to the salt flats of the Great Salt Lake and separate the Malad Valley on the east from the Blue Creek, Howell, and Pocatello Valleys on the west; and (4) the Promontory Mountains, North Promontory Mountains, and Summer Range Mountains that run north and south and separate Blue Creek, Howell, and Pocatello Valleys on the east from the Hansel Valley and the lake plains on the west side of the survey area.

The parent materials of the soils on the Clarkston, Wasatch, and Wellsville Mountains weathered mainly from quartzite, sandstone, limestone, and conglomerate rocks. These rocks range in age from younger Tertiary to older Precambrian. The influence of the parent material, although altered by cofactors of time, climate, and vegetation, is identifiable in the soils in these areas. The variation in texture, presence of rock fragments, depth to bedrock, color, and carbonate content are the most noticeable properties attributable to parent materials.

The Agassiz, Foxol, and Richmond soils formed in these materials. They have bedrock at depths of less than 20 inches. The Foxol soils formed in materials weathered from quartzite and are noncalcareous throughout. The Agassiz and Richmond soils formed mainly in material weathered from limestone. The Agassiz soils are calcareous at a depth of about 14 inches. The Richmond soils are very strongly calcareous throughout. Both the Agassiz and the Richmond soils have gravel and cobblestones of limestone in their profiles. The Goring and Lucky Star soils formed mostly in materials weathered from red sandstone and conglomerate of the Wasatch formation. They are free of carbonate to depths of 60 inches or more and have hues of 7.5YR or redder below the A horizon. The color is influenced strongly by parent materials.

An inextensive but distinct group of soils along the Wasatch Mountain front formed in alluvium derived from gneiss, schist, quartzite, and some granite rocks. The Draper and Dagor soils formed in loamy materials from this source. The Kilburn and Wasatch soils formed in the gravelly and cobbly sandy loam and sand. All these soils are noncalcareous throughout and are high in content of mica minerals.

The parent materials from the West Mountains, Blue Spring Hills, Promontory Mountains, and the Summer Range Mountains are similar. They weathered mainly from limestone and sandstone but some weathered from quartzite and dolomite. These rocks are of younger Tertiary to Permian age, dominantly of the Oquirrh formation. The influence of parent material is most noticeable in variation in texture, presence of rock fragments, depth to bedrock, and carbonate content. The Promo, Sandall, Rozlee, Middle, and Broad soils formed in this kind of material. The Promo soils have limestone bedrock at a depth of less than 20 inches. They are calcareous throughout and have more than 35 percent limestone rock fragments in the profile. The Sandall, Rozlee, and Middle soils are all 20

to 40 inches deep to limestone. The Broad soils are 20 to 40 inches deep to sandstone.

On the north end of Hansel Valley west of the North Promontory Mountain is a basalt flow. The Snowville, Saxby, Gemson, and some of the Middle soils formed in the residium. In the Middle soils the basalt is mainly a surface mantle. The Snowville and Saxby soils have basalt bedrock at a depth of less than 20 inches. Both soils have gravel and cobblestones of basalt throughout the profile. These soils are calcareous throughout and have layers of carbonate accumulation. The Snowville soils have developed indurated carbonate hardpans. The Gemson soils formed in colluvium and alluvium from the basalt and have B horizons of silty clay or heavy silty clay loam that are strongly enriched with clay. They are noncalcareous in the A and upper B horizons but have layers of carbonate accumulation at depths of about 30 inches.

Climate

The principal effect of climate on soil formation in Box Elder County, Eastern Part, has been the direct influence of precipitation and temperature on the weathering of the parent materials, the accumulation of organic matter in the A horizons, the leaching and accumulation of carbonates, and the redistribution of clay. In addition, the climate directly affects the kinds of plant and animal life that can thrive and thus contribute to soil development.

The climate of this area ranges from semiarid to humid continental. Winters are cold and summers are warm. The average annual precipitation ranges from about 6 inches on the lake plains at the lower elevations to over 30 inches in the higher mountains. Most of the precipitation comes in the form of snow during the winter and early spring. The seasonal and daily temperatures vary widely. The mean annual air temperature ranges from about 50° F. on the lower lake plains to 35° F. in the higher mountains at elevations of 9,000 feet. The frost-free period ranges mainly from 60 to 165 days. In the mountain areas frost occurs in every month in some years.

In general the climate is a cofactor with elevation. The precipitation increases as the elevation increases, and the mean temperature and the frost-free period decrease as the elevation decreases. Because of the exposure, there is some overlap in the different designated climate zones. Also, the presence of the Great Salt Lake, to the south of the survey area, has a moderating effect on temperature in the area.

In the semiarid climate on the lake plains, lower lake plains, lower lake terraces, and recent fans, the average annual precipitation is 6 to 12 inches. The mean annual temperature is 45° to 50° F., and the frost-free period is 85 to 130 days. Elevation ranges from 4,225 to 4,500 feet.

The soils in the semiarid climate typically have light-colored A horizons that have accumulated only small amounts of organic matter. The Bram, Drum, Harding, Mellor, and Uffens soils are the dominant soils. They are on the lake plains and lower lake terraces. The Uffens and Drum soils in the drier part have accumulated less than 1 percent organic matter in the A horizon. The other soils have about 1 to 2 percent organic matter in the A horizon. All of these soils are high in exchangeable sodium and soluble salts and are calcareous throughout. They have formed distinct layers of carbonate accumulation at depths of 12 to 21 inches. The Mellor, Uffens, and Harding soils have clay-enriched B horizons. The clay formation is attributed to the high sodium influence rather than to the normal translocation by water from precipitation moving through the soil.

On the slightly higher terraces in the semiarid climate are the Palisade and Saxby soils and some of the Thiokol, Stingal, Windmill, Eccles, and Sanpete soils. None of these soils have clay-enriched B horizons, but they do have organic matter accumulation in the A horizon and show movement of carbonates. The Sanpete, Palisade, Thiokol, and Saxby soils have distinct layers of carbonate accumulation.

In the dry subhumid climate on the intermediate terraces, high terraces, fans, and lower mountain slopes, the average annual precipitation is 12 to 18 inches. The mean annual temperature ranges from 45° to 50° F., and the frost-free period ranges from 100 to 160 days. Elevation ranges from 4,400 to 5,600 feet. This is the dominant climate for the survey area. All or part of more than 70 of the soil series in this area are in this climate.

Most of the soils in the dry subhumid climate have accumulated enough organic matter at a depth between 7 and 10 inches to give a dark color. However, some of the soils, for example, the Hansel, Thiokol, Stingal, Windmill, Pomat, Sheeprock, and Sanpete soils, have accumulated only 1 to 3 percent organic matter and have light-colored A horizons. The Placeritos, Sheeprock, Pomat, Promo, and Richmond soils have an accumulation of organic matter only in the A horizons.

A large number of the soils have formed strong layers of carbonate accumulation in addition to about 2 to 4 percent organic matter. Some of the more extensive soils that have developed layers of carbonate accumulation are the Hupp, Middle, Kidman, Kearns, Sanpete, Sandall, Thiokol, Fielding, Honeyville, and Sterling soils.

In addition to the horizons of organic matter and carbonate accumulation, some soils have formed clay-enriched B horizons. Some of the more extensive soils that have dark-colored A horizons, layers of carbonate accumulation, and clay-enriched B horizons are the Timpanogos, Bingham, Parleys, Mendon, and Gemson soils.

Other soils that have clay-enriched B horizons and dark-colored A horizons but lack layers of carbonate accumulation are the Hendricks soils. DeJarnet, Hendricks, and Mendon soils are dark colored and have an accumulation of more than 1 percent organic matter to a depth of more than 20 inches. The Hendricks and DeJarnet soils are in climates that are marginal to moist subhumid.

The accumulation of organic matter, leaching and distribution of carbonates, and translocation of clay are the main influences of climate on these soils.

The moist subhumid climate occurs dominantly on mountain slopes and older fans. Average annual precipitation ranges from 16 to 24 inches. The mean annual temperature ranges from 39° to 45° F., and the frost-free period ranges mainly from 60 to 120 days. Elevation ranges from 5,200 to 8,000 feet.

The soils in the moist subhumid climate have dark A horizons that have accumulated about 3 to 10 percent organic matter. Essentially all carbonate and most soluble salts have been leached to a depth of 23 to 50 inches or more. The Elzinga, Maughan, Smarts, and

Goring soils have dark colors and more than 1 percent organic matter to a depth of more than 20 inches. The shallow Agassiz and Foxol soils have no horizons other than A horizons with accumulation of organic matter. The Picayune and Broad soils have horizons of carbonate accumulation at a depth of 23 to 36 inches. The Elzinga, Broad, Goring, Manila, Maughan, Smarts, and Yeates Hollow soils have clay-enriched B horizons. The Maughan and Elzinga soils have bleached A2 horizons.

In summary, except for small local areas that are influenced by plant material or erosion, the soils in the semiarid areas have light-colored A horizons (ochric epipedons), and most are calcareous throughout and are affected by salt and alkali. Most soils in the dry subhumid climate and essentially all the soils in the moist subhumid and humid climates have dark-colored A horizons (mollic epipedons) and are partly or completely leached of carbonates and most soluble salts. Usually, the higher the precipitation, the higher the organic-matter content, the darker the surface layer, the thicker the A and B horizons, and the greater the depth to carbonates.

The influence of climate in soil formation is closely associated with topography and the kinds and amounts of vegetation.

Plant and animal life

The principal effects of plant and animal life on soil formation are the accumulation of organic matter and the translocation of plant nutrients from the lower to the upper horizons. Also, living organisms affect soil structure and porosity and thus influence the rate of air and water movement through the soil. Plants and animals mix the soil and may retard horizon formation. The decay of forest litter causes the formation of acids. These acids in solution hasten the leaching processes, and bases are leached rapidly from the soil.

Bacteria and fungi play an important role in the formation of soils by breaking down undecomposed organic matter and changing it to humus. Some bacteria take nitrogen from the air and change it into a form that can be used by plants. The life processes of earthworms, small rodents, insects, slugs, and snails also influence soil development.

In Box Elder County, Eastern Part, the native vegetation is a cofactor with climate in soil formation. Precipitation and temperature vary with elevation and exposure. These climatic factors directly influence the kinds and amounts of vegetation. Past grazing use has also been a strong factor in determining present plant composition.

The present vegetation on the saline-alkali soils—Drum, Uffens, Mellor, Harding, and Bram soils—in the semiarid climate consists largely of greasewood, shadscale, winterfat, pickleweed, and kochia. These soils are low in organic matter because of the sparse vegetation.

The most noticeable result of the lack of vegetation is that shown by the soils on the nearly barren flood plains and lake plains bordering Great Salt Lake. The Saltair and Lakeshore soils that formed on this plain have very thin or no A1 horizons.

The native vegetation on the soils in the dry subhumid climate is mainly bluebunch wheatgrass, squirreltail, Indian ricegrass, and juniper. This predominantly grass vegetation provided rather large amounts of organic matter to the soils. The soils in this climate usually have dark-colored A horizons with 1 to 4 percent organic matter. Some of the soils under the more dense stands of juniper have light-colored A horizons and a lower organic-matter content.

The somewhat poorly drained and poorly drained Roshe Springs, Logan, Woods Cross, Cudahy, Collett, and Greenson soils have dominant vegetation of wiregrass, sedges, saltgrass, meadow, foxtail, and Kentucky bluegrass. This vegetation has contributed a large amount of organic matter to the soil. These soils generally have 3 to 10 percent organic matter in the surface layer.

The native vegetation on the soils in the moist subhumid climate is mainly big sagebrush, Gambel oak, bitterbrush, lupine, bluebunch wheatgrass, Sandberg bluegrass, squirreltail, slender wheatgrass, snowberry, and serviceberry. Because of higher precipitation, yields of plants are higher in the moist subhumid climate than in the dry subhumid climate. Thus, the organic-matter content of the soils is generally higher. The Goring, Manila, Obray, Yeates Hollow, Picayune, and Broad soils have about 3 to 5 percent organic matter in their A horizons. The Elzinga, Maughan, and Smarts soils are under dense stands of maple. These soils have dark-colored A horizons with 5 to 12 percent organic matter.

The vegetation on the soils in the humid climate is mainly aspen, Douglas-fir, or alpine fir, with an understory of grasses and shrubs. The Lucky Star soils occur under aspen. These soils have dark-colored A horizons, distinct A2 horizons, and clay-enriched B horizons. The Bickmore soils occur under Douglas-fir and alpine fir. They also have a dark-colored A horizon and clay-enriched B horizon. They formed in parent materials from limestone and have horizons of carbonate accumulation.

Relief

Relief or landform influences soil formation principally as it affects runoff, drainage, and microclimate. The microclimatic influences are associated mainly with exposure and elevation. The dominant landforms or topographic features in Box Elder County, Eastern Part, are (1) lake plains, low lake terraces, valley bottoms, and flood plains; (2) intermediate and high lake terraces, deltas, and fans; and (3) older fans, foothills, and mountain slopes and ridges.

Lake plains, low lake terraces, valley bottoms, and flood plains.—These landforms occur at elevations of about 4,200 to 4,375 feet. The climate is mainly semiarid or dry subhumid. The variation in elevation is gradual. The terrace breaks separating the lower terraces from the lake plains and flood plains are relatively short or indefinite. Some of the narrow valley bottoms and drainageways are entrenched, and the breaks to higher terraces are more distinct. On the level to gently sloping lake plains, low lake terraces, valley bottoms, and recent flood plains, drainage is restricted. The lower lying soils are mainly somewhat poorly drained or poorly drained, or they are strongly affected by salt and alkali.

The Saltair and Lakeshore soils and Playas that occur on the lake plain, immediately above the water level of the Great Salt Lake, are strongly affected by salt and alkali. They commonly are overflowed by water and have a water table at or near the surface much of the time. These soils have no developed soil horizons other than the

layers of salt accumulation. Most of the soils on the higher lake plains and lower lake terraces, such as Airport, Lasil, Warm Springs, Lewiston, Collett, and Greenson soils, are somewhat poorly drained. The Honeyville, Stokes, and Fielding soils that occur slightly higher on the terraces are moderately well drained to well drained. All of these soils have dark-colored A horizons that have about 1 to 5 percent organic matter. They have formed layers of carbonate accumulation within a depth of 40 inches. The Airport, Lasil, and Stokes soils have clay-enriched B horizons that are sodium affected. The water table and salt and alkali in these soils are attributable largely to position.

The Uffens, Drum, Mellor, Harding, and Bram soils occur in the drier lake-plain areas. They are strongly affected by alkali but have a lower salt content than the Saltair and Lakeshore soils. Mainly, these soils have 40 to 70 percent exchangeable sodium in the C horizons. The water table is generally below a depth of 40 inches. These soils have light-colored A horizons with only small amounts of organic matter. The Mellor, Harding, and Bram soils have clay-enriched B horizons that are sodium affected.

The poorly drained Logan, Roshe Springs, and Magna soils, the somewhat poorly drained Placeritos and Kirkham soils, and the moderately well drained Sunset soils occur in stream drainageways, on flood plains of permanent streams, and along valley bottoms. These soils are wet because of position. The poorly drained soils have a water table generally within 20 inches of the surface. The somewhat poorly drained and moderately well drained soils have a water table generally at a depth between 20 and 40 inches. The poorly drained soils are in drainageways and on flood plains at slightly lower elevations than the somewhat poorly drained soils. The wetness has influenced the soil formation. The poorly drained soils have dark-colored A horizons that have 3 to 10 percent or more organic matter and have layers of carbonate accumulation mainly within a depth of 16 inches. The somewhat poorly drained soils have about 2 to 5 percent organic matter in the A horizon.

Intermediate and high lake terraces, deltas, and fans.— These landforms occur at elevations of 4,375 to 5,200 feet. The climate is dominantly dry subhumid but is semiarid in the western part of the survey area.

The terraces are dominantly broad and nearly level to sloping. The escarpments separating the various terraces are readily observable in most areas and vary in elevation by about 10 to 50 feet or more. They are dominantly steep or very steep. The deltas and fans occur mainly on the breaks from the higher terraces but are also prominent on some lower terraces. They have slopes ranging from nearly level to steep, but slopes are dominantly less than 15 percent.

The soils that formed on these terraces, deltas, and fans are mostly well drained. The sandy and gravelly Sterling and Sanpete soils on the deltas are somewhat excessively drained. Most of the cultivated soils of this area are on these landforms. In general, these soils have dark-colored A horizons that have 1 percent or more organic matter, but some of the soils, such as the Hansel, Thiokol, Windmill, Stingal, and Eccles soils, have light-colored A horizons. These light-colored soils are in the drier part of the dry subhumid climate or in the semiarid climate.

The Pomat soils on the higher terraces also have a light-colored A horizon. These soils occur mainly on steep or very steep terrace escarpments where runoff and erosion have kept the soils from forming horizons other than a slight accumulation of organic matter in the A horizon. Mainly, the soils on the higher terraces are older and more strongly developed than the slightly younger soils on the lower terraces, fans, and deltas.

Older fans, foothills, and mountain slopes and ridges.— The prominent mountains are listed in the following paragraphs.

The Clarkston, Wellsville, and Wasatch Mountains are on the east side of the survey area. These mountains rise abruptly from the lake terraces to an elevation of 8,000 feet or more. The climate is mainly moist subhumid but ranges to humid at some of the higher elevations.

The West Mountains and Blue Spring Hills join each other and extend from the Idaho line on the north to the salt flats of Great Salt Lake on the south. They are about 6 to 12 miles across and separate the Malad Valley on the east from the Blue Creek, Howell, and Pocatello Valleys on the west. These mountains range in elevation from about 5,200 feet to 7,300 feet. The climate is mainly dry subhumid but is moist subhumid at some of the higher elevations.

The Promontory Mountains and North Promontory Mountains run nearly continuously north and south from the Idaho line to a projected point about 15 miles south into Great Salt Lake. These mountains generally range in elevation from about 5,200 to 7,000 feet, but some individual peaks are higher. The climate is mainly dry subhumid but is semiarid on some of the lower foothills. These mountains are about 2 to 6 miles across and separate the Howell, Blue Creek, and Pocatello Valleys on the east from Hansel Valley on the west. Also included is Fremont Island about 4 miles offshore from Promontory Point in Great Salt Lake.

The Summer Range Mountains are west of Hansel Valley near the Idaho line. This small mountain area is about 10 to 12 miles long and 2 to 5 miles across. The highest peak is about 6,300 feet in elevation. These mountains have mainly a semiarid or dry subhumid climate.

The older fans are mainly on the lower mountain slopes and foothills just above the highest terraces where alluvium and colluvium have accumulated. The influence of relief in the mountains, on the older fans, and in the foothills is so interrelated with climate, vegetation, and parent material that the individual effect is difficult to evaluate. The most noticeable influence is in exposure and elevation. The south- and west-facing slopes are more directly facing the sun and are warmer than the east- and north-facing slopes. Runoff from snowmelt and rainfall is higher on the south and west slopes. Water for soil development and plant growth is therefore less on south and west slopes than on north and east exposures, where precipitation is utilized by plants to produce growth or percolates through the soils to leach salts and move clay.

This influence of exposure is distinctly noticeable in the Promontory Mountains. The Sandall, Promo, and Rozlee soils are on the steep and very steep south- and west-facing exposures of mountain slopes and have a mean annual temperature of 47° to 54° F. These soils formed under juniper and a sparse understory of perennial grasses and shrubs. They are calcareous throughout and

are underlain by bedrock at a depth of less than 40 inches. These soils have thin, light-colored A horizons and weak or no B horizons. The solum is about 14 inches thick.

In comparison, the Broad soils on the north-facing slopes of the same mountains have a cooler mean annual temperature of less than 47°. These soils formed under grasses and shrubs and only scattered juniper. They have dark-colored A horizons and clay-enriched B horizons. The solum is about 28 inches thick. These soils are noncalcareous to a depth of 23 to 36 inches and have bedrock at a depth of 30 to 40 inches.

The most strongly developed soils of this survey area are on these older landscapes. The Hendricks and Forsgren soils occur on mountain foot slopes and alluvial fans just above the highest Bonneville Lake terraces. Organic matter has accumulated to a depth of 20 to 30 inches in the Hendricks soil, but to slightly shallower depths in the Forsgren soil. These soils have developed moderate to strong, reddish-colored, clay-enriched B horizons that are 20 to more than 40 inches thick. Carbonates have been leached from the A1 and B2t horizons. Clay content in the B2t horizon is about 1.5 times that of the A1 horizons, and clay films are on ped surfaces.

The Goring and Manila soils are on mountain slopes and alluvial fans above the Bonneville Lake terraces at elevations of 5,100 to 7,000 feet and represent some of the oldest soils in the survey area. These soils formed in materials derived from sandstone and quartzite under grasses and shrubs. They are slightly acid to medium acid throughout. These soils have thick, dark-colored A1 horizons and strong, clay-enriched B horizons that are 22 to 49 inches thick.

Time

Time is necessary for the factors of soil formation to act on parent material. The distinctness of horizons formed in soils depends in part upon time. The soils in Box Elder County, Eastern Part, range from younger soils that have little or no horizon differentiation or profile development to mature soils that have well-developed profile characteristics.

A built-in clock is available in the area in the remnants of ancient Lake Bonneville. Soils were forming above the highest lake terraces for thousands of years before soils started to form in the lake terraces. Soils likewise started to form on the higher lake terraces while the lower terraces were still under water. Those soils on the flood plains were the last to start forming.

In this survey area the least horizon differentiation occurs in the soils of the lake plains, low lake terraces, and more recent alluvial deposits in the semiarid and dry subhumid climatic zones. The Placeritos, Sheeprock, Pomat, Etil, Kirkham, Sunset, and Martini soils have no horizons other than slight accumulations of organic matter in the A horizon. The Bram, Palisade, Thiokol, and Sanpete soils formed in similar but slightly older alluvial and lake sediment deposits in the same climatic zones. They have developed horizons of carbonate accumulation in addition to accumulation of organic matter in the A horizon.

The oldest and most strongly developed soils occur on the mountain slopes and older fans above the highest lake terraces. The Goring, Manila, and Hendricks soils represent some of the older soils in this survey area. They have thick, dark-colored A horizons and strong, clay-enriched B horizons and are essentially free of carbonate.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodlands; in developing rural areas; in performing engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*9*) and later revised (*8*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study. Therefore, readers interested in developments of the current system should search the latest literature available (*12*, *7*). In table 8 the soil series of Box Elder County, Eastern Part, are placed in some categories of the current system.

The current system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system soil properties that are observable and measurable are used as a basis for classification. The properties are chosen so that the soils of similar genesis, or the way they formed, are grouped together.

ORDER: Ten soil orders are recognized in this system. They are Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions are the Entisols, Inceptisols, and Histosols, which occur in several different climates.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of those soil characteristics that seem to produce classes with greatest genetic similarities. The suborder narrows the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of water-logging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated or those that have pans that interfere with the growth of roots or the movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Abela	Loamy-skeletal, mixed, mesic	Aridic Calcixerolls	Mollisols.
Agassiz	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols.
Airport	Fine-silty, mixed, mesic	Typic Natraquolls	Mollisols.
Anty	Coarse-loamy, mixed, mesic	Typic Calcixerolls	Mollisols.
Arave	Fine-loamy, mixed, mesic	Aquic Natrustalfs	Alfisols.
Bickmore	Loamy-skeletal, mixed	Argic Pachic Cryoborolls	Mollisols.
Bingham	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Calcic Argixerolls	Mollisols.
Blue Star	Coarse-loamy, mixed, mesic	Calciorthidic Haploxerolls	Mollisols.
Blue Star, gravelly subsoil variant.	Sandy-skeletal, mixed, mesic	Calciorthidic Haploxerolls	Mollisols.
Bram	Coarse-silty, mixed, mesic	Xerollic Calciorthids	Aridisols.
Broad	Loamy-skeletal, mixed, frigid	Calcic Argixerolls	Mollisols.
Collett	Fine, mixed, mesic	Aquic Calciustolls	Mollisols.
Collinston	Fine-silty, mixed, mesic	Typic Calcixerolls	Mollisols.
Cudahy	Fine-silty, mesic	Petrocalcic Calciaquolls	Mollisols.
Dagor	Fine-loamy, mixed, mesic	Cumulic Haploxerolls	Mollisols.
DeJarnet	Loamy-skeletal, mixed, mesic	Calcic Pachic Haploxerolls	Mollisols.
Draper	Fine-loamy, mixed, mesic	Cumulic Haplustolls	Mollisols.
Drum	Fine-silty, mixed, mesic	Typic Calciorthids	Aridisols.
Eccles	Coarse-loamy, mixed, mesic	Xerollic Calciorthids	Aridisols.
Eccles, sandy variant	Coarse-loamy, mixed, mesic	Xerollic Calciorthids	Aridisols.
Elzinga	Loamy-skeletal, mixed	Pachic Paleborolls	Mollisols.
Etil	Carbonatic, mesic	Typic Xeropsamments	Entisols.
Fielding	Fine-silty, mixed, mesic	Typic Calcixerolls	Mollisols.
Forsgren	Fine, montmorillonitic, mesic	Vertic Argixerolls	Mollisols.
Foxol	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols.
Francis	Sandy, mixed, mesic	Entic Haploxerolls	Mollisols.
Fridlo	Fine-silty, mixed, mesic	Typic Natrixerolls	Mollisols.
Gemson	Fine, montmorillonitic, mesic	Calcic Argixerolls	Mollisols.
Gooch	Fine-loamy, mixed, mesic	Aquic Calciorthids	Aridisols.
Goring	Fine, montmorillonitic, frigid	Pachic Palexerolls	Mollisols.
Goring, brown subsoil variant.	Fine, montmorillonitic, frigid	Pachic Argixerolls	Mollisols.
Greenson	Fine-silty, mixed, mesic	Aquic Calciustolls	Mollisols.
Hansel	Fine-silty, mixed, mesic	Xerollic Haplargids	Aridisols.
Harding	Fine, mixed, mesic	Xerollic Natrargids	Aridisols.
Hendricks	Fine-silty, mixed, mesic	Pachic Argixerolls	Mollisols.
Honeyville	Fine, mixed, mesic	Typic Calcixerolls	Mollisols.
Hupp	Loamy-skeletal, mixed, mesic	Calcic Haploxerolls	Mollisols.
James Canyon	Fine-loamy, mixed, mesic	Cumulic Haplaquolls	Mollisols.
Kapod	Loamy-skeletal, mixed, mesic	Calcic Argixerolls	Mollisols.
Kearns	Fine-silty, mixed, mesic	Calcic Haploxerolls	Mollisols.
Kearns, high lime variant.	Fine-loamy, carbonatic, mesic	Typic Calcixerolls	Mollisols.
Kidman	Coarse-loamy, mixed, mesic	Calcic Haploxerolls	Mollisols.
Kilburn	Loamy-skeletal, mixed, mesic	Typic Haploxerolls	Mollisols.
Kirkham	Fine-silty, mixed, mesic	Fluvaquentic Haplustolls	Mollisols.
Lakeshore	Coarse-silty, mixed, mesic	Typic Salorthids	Aridisols.
Lasil	Fine-silty, mixed, mesic	Typic Natrustalfs	Alfisols.
Lewiston	Coarse-loamy, mesic	Aeric Calciaquolls	Mollisols.
Logan	Fine-silty, mesic	Typic Calciaquolls	Mollisols.
Lucky Star	Loamy-skeletal, mixed	Cryic Paleborolls	Mollisols.
Magna	Fine, mixed, mesic	Typic Calciaquolls	Mollisols.
Manila	Fine, montmorillonitic, frigid	Typic Argixerolls	Mollisols.
Martini	Coarse-loamy, mixed, mesic	Fluventic Haploxerolls	Mollisols.
Maughan	Fine, montmorillonitic	Pachic Paleborolls	Mollisols.
Mellor	Fine-silty, mixed, mesic	Xerollic Natrargids	Aridisols.
Mendon	Fine-silty, mixed, mesic	Calcic Pachic Argixerolls	Mollisols.
Middle	Loamy-skeletal, mixed, mesic	Calcic Haploxerolls	Mollisols.
Millville	Coarse-silty, carbonatic, mesic	Typic Haploxerolls	Mollisols.
Munk	Loamy-skeletal, mixed, mesic	Typic Calcixerolls	Mollisols.
Obray	Fine, montmorillonitic, frigid	Vertic Haploxerolls	Mollisols.
Palisade	Coarse-loamy, mixed, mesic	Xerollic Calciorthids	Aridisols.
Parleys	Fine-silty, mixed, mesic	Calcic Argixerolls	Mollisols.
Pass Canyon	Loamy-skeletal, mixed, mesic	Lithic Argixerolls	Mollisols.
Payson	Fine, mixed, mesic	Typic Natrustalfs	Alfisols.
Peteetneet, moderately deep variant.	Loamy, mixed, euic, mesic	Terric Medisaprists	Histosols.
Picayune	Fine-loamy, mixed, frigid	Calcic Haploxerolls	Mollisols.
Placeritos	Fine-silty, mixed (calcareous), mesic	Aquic Xerofluvents	Entisols.
Pogal	Coarse-silty, mixed, mesic	Xerollic Calciorthids	Aridisols.
Pomat	Coarse-silty, mixed (calcareous), mesic	Xeric Torriorthents	Entisols.
Promo	Loamy-skeletal, mixed (calcareous), mesic	Lithic Xeric Torriorthents	Entisols.

TABLE 8.—*Classification of soil series*—Continued

Series	Family	Subgroup	Order
Red Rock	Fine-silty, mixed, mesic	Cumulic Haploxerolls	Mollisols.
Refuge	Coarse-loamy, mixed, mesic	Salorthidic Haplustolls	Mollisols.
Richmond	Loamy-skeletal, carbonatic, mesic	Lithic Xerorthents	Entisols.
Ridd	Loamy-skeletal, mixed, mesic	Typic Argixerolls	Mollisols.
Roshe Springs	Fine-loamy, mesic	Typic Calciaquolls	Mollisols.
Rozlee	Loamy-skeletal, mixed, mesic	Aridic Calcixerolls	Mollisols.
Saltair	Fine-silty, mixed, mesic	Typic Salorthids	Aridisols.
Sandall	Loamy-skeletal, carbonatic, mesic	Xerollic Calciorthids	Aridisols.
Sanpete	Loamy-skeletal, carbonatic, mesic	Xerollic Calciorthids	Aridisols.
Saxby	Loamy-skeletal, mixed, mesic	Lithic Xerollic Calciorthids	Aridisols.
Sheeprock	Sandy-skeletal, mixed, mesic	Xeric Torriorthents	Entisols.
Smarts	Loamy-skeletal, mixed, frigid	Pachic Ultic Argixerolls	Mollisols.
Snowville	Loamy, mixed, mesic, shallow	Petrocalcic Palexerolls	Mollisols.
Sterling	Loamy-skeletal, mixed, mesic	Typic Calcixerolls	Mollisols.
Stingal	Coarse-silty, mixed, mesic	Xerollic Camborthids	Aridisols.
Stokes	Fine, mixed, mesic	Aquic Natrixeralfs	Alfisols.
Sunset	Coarse-loamy, mixed, mesic	Fluvaquentic Haplustolls	Mollisols.
Syracuse	Coarse-loamy, mixed, mesic	Aquic Haplustolls	Mollisols.
Thiokol	Fine-silty, mixed, mesic	Xerollic Calciorthids	Aridisols.
Timpanogos	Fine-loamy, mixed, mesic	Calcic Argixerolls	Mollisols.
Uffens	Fine-loamy, mixed, mesic	Typic Natrargids	Aridisols.
Warm Springs	Fine-loamy, mesic	Aeric Calciaquolls	Mollisols.
Wasatch	Sandy, mixed, mesic	Entic Haploxerolls	Mollisols.
Wasatch, gravelly subsoil variant.	Sandy-skeletal, mixed, mesic	Entic Haploxerolls	Mollisols.
Wheelon	Fine-silty, mixed, mesic	Calcixerollic Xerochrepts	Inceptisols.
Wheelon, shallow variant.	Loamy-skeletal, mixed, mesic, shallow	Calcixerollic Xerochrepts	Inceptisols.
Windmill	Loamy-skeletal, carbonatic, mesic	Xerollic Camborthids	Aridisols.
Woods Cross	Fine, montmorillonitic, mesic	Cumulic Hapaquolls	Mollisols.
Yeates Hollow	Clayey-skeletal, montmorillonitic, frigid	Typic Argixerolls	Mollisols.

SUBGROUP: Great groups are subdivided into subgroups, one that represents the central (typic) segment of the group and others called intergrades, that have properties of another great group, suborder, or order. The names of the subgroups are derived by placing one or more adjectives before the name of the great group.

FAMILY: Families are separated within the subgroup primarily on the basis of properties important to growth of plants or behavior of soils where used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. Table 8 gives the family of each series represented in the survey area, though some family designations may be changed as more information is obtained.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soils, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

Laboratory Analyses

Results of laboratory analyses of selected soil profiles are shown in table 9. The analyses were made by the Soil Conservation Service and the Utah State University Soils Laboratory, Logan, Utah.

Methods of Analyses

All analyses were made on air-dry samples of fractions less than 2 millimeters, except the coarse fragments determination. Results were recalculated to an oven-dry basis. Only coarse fragments in table 9 are reported as a percentage of the whole soil. In the following discussion methods are identified by code. An explanation of the codes and details of the analyses used may be found in Soil Survey Investigations Report No. 1, Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples (*13*).

Particle-size distribution was determined by the pipette method (3A1), organic carbon by wet combustion (6A1a). Calcium carbonate equivalent was calculated from the amount of carbon dioxide evolved following hydrochloric acid (6E1b). The water content at 15 atmospheres pressure (4B2) was measured in a pressure membrane apparatus, and pH was measured with a glass electrode (8C1a, 8C1b). Exchangeable bases (6P2a, 6Q2a) were leached from the soil with ammonium acetate (5B1b), and a correction for soluble salts was made using the composition of the saturation extract (8A1). The exchangeable sodium percentage is the amount of exchangeable sodium in percent of the cation exchange capacity determined by the sodium acetate method (5A2a). Soluble salt was estimated from the electrical conductivity of a saturated paste in a Bureau of Soils cup (8A2). The electrical conductivity of the saturation extract was also determined (8A1a).

TABLE 9.—*Laboratory analyses*

[Analyses made by the Soil Conservation Service and

Soil	Horizon	Depth	Size class and diameter of particles: Total: Sand (2.0–0.05 mm.)	Total: Silt (0.05–0.002 mm.)	Total: Clay [2] (<0.002 mm.)	Sand fraction: Very coarse sand (2.0–1.0 mm.)	Sand fraction: Coarse sand (1.0–0.5 mm.)	Sand fraction: Medium sand (0.5–0.25 mm.)	Sand fraction: Fine sand (0.25–0.1 mm.)	Sand fraction: Very fine sand (0.1–0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Abela gravelly loam.	A11	0–5	28	54	18	7	3	1	4	12
	A12	5–14	25	55	20	6	3	1	4	11
	B2	14–28	27	52	21	6	3	2	5	11
	C1ca	28–39	49	35	16	16	9	4	8	12
	C2ca	39–49	53	32	15	19	10	4	9	11
	C3	49–60	50	38	12	19	10	4	7	10
Bram silt loam.	A11	0–2	12	76	12	0	1	0	2	9
	A12	2–5	13	72	15	0	0	0	2	11
	B2	5–12	10	74	16	0	0	0	2	8
	C1ca	12–18	13	72	15	0	0	0	4	9
	C2ca	18–23	11	70	19	0	0	0	2	9
	C3	23–36	22	60	18	0	0	0	4	18
	C4	36–64	18	63	19	0	0	0	2	16
Collett silty clay loam.	Ap	0–7	4	59	37	0	0	0	1	3
	A1	7–14	3	60	37	0	0	0	1	2
	B2	14–23	1	55	44	0	0	0	0	1
	C1ca	23–30	1	55	44	0	0	0	0	1
	C2ca	30–45	3	59	38	0	0	0	0	3
	C3	45–66	2	58	40	0	0	0	0	2
DeJarnet gravelly silt loam.	Ap1	0–4	24	59	17	2	2	1	7	12
	Ap2	4–10	21	58	21	2	2	1	6	10
	B21	10–20	25	53	22	2	2	1	7	13
	B22	20–28	32	49	19	2	2	1	10	17
	B23	28–34	35	47	18	2	2	2	11	18
	Cca	34–50	51	34	15	3	3	3	22	20
Eccles fine sandy loam.	Ap	0–6	59	23	18	7	13	5	14	20
	A1	6–11	57	24	19	6	13	6	14	18
	B2	11–18	62	19	19	5	12	7	19	19
	C1ca	18–28	66	16	18	4	10	6	23	23
	C2ca	28–45	56	25	19	1	1	1	16	37
	C3	45–62	51	34	15	1	1	0	5	44
Fielding silt loam.	Ap1	0–6	17	59	24	0	0	0	2	15
	Ap2	6–10	18	58	24	0	0	0	3	15
	B21	10–15	19	58	23	0	0	0	2	17
	B22	15–19	16	60	24	0	0	0	2	14
	C1ca	19–25	20	61	19	0	0	0	2	18
	C2ca	25–34	14	64	22	0	0	0	2	12
	C3	34–52	5	71	24	0	0	0	0	5
	C4	52–66	5	61	34	0	0	0	1	4
Forsgren silt loam.	Ap	0–5	14	60	26	0	0	0	1	13
	A1	5–8	14	60	26	0	0	0	1	13
	B21t	8–16	13	55	32	0	0	0	1	12
	B22t	16–34	12	47	41	0	0	0	1	11
	B23t	34–38	16	45	39	0	0	0	2	14
	B3t	38–52	16	52	32	0	0	0	1	15
	C	52–66	23	60	17	0	2	2	4	15
Fridlo silt loam.	Ap	0–6	13	63	24	0	0	0	3	10
	A1	6–9	4	72	24	0	0	0	1	3
	B21t	9–15	4	70	26	0	0	0	2	2
	B22t	15–21	8	63	29	0	0	0	1	7
	B3ca	21–29	10	69	21	0	2	2	1	5
	C1ca	29–43	3	70	27	0	0	0	1	2
	C2	43–60	2	64	34	0	0	0	0	2

See footnotes at end of table.

of selected soils [1]

the Utah State University Soils Laboratory, Logan]

Coarse fragments (2 mm. to 3 inches)	Organic carbon	Calcium carbonate equivalent	Water content at 15 atmospheres	Reaction		Cation exchange capacity	Exchangeable bases (milliequivalents per 100 grams of soil)		Exchangeable sodium	Soluble salt (Bureau cup)	Electrical conductivity
				Saturated paste	1:5		Sodium	Potassium			
Percentage by weight	*Percent*	*Percent*	*Percent*	*pH*	*pH*	*Meq per 100 gm of soil*			*Percent*	*Percent*	*Mmhos per cm at 25° C*
44	2.5	9	10.4	7.5	8.6	21.1	0.2	1.9	1	0.05	2.2
44	1.3	11	9.9	7.5	8.7	19.7	.3	1.7	2	.05	1.0
44	1.0	15	10.0	7.6	8.8	18.0	.4	.8	2	.04	.7
69	.7	26	6.9	7.8	9.0	10.6	.5	.5	5	.04	1.2
90	.6	36	6.4	7.9	9.2	8.6	.5	.5	6	.03	1.4
73	.3	27	5.7	8.0	9.3	8.8	.5	.8	6	.04	1.4
0	1.3	13	8.6	8.0	9.2	16.7	.7	3.9	4	.05	1.4
0	.9	10	8.9	8.2	9.4	17.6	1.9	2.6	9	.10	3.8
0	.7	16	10.8	8.0	9.6	17.9	5.6	2.7	31	.50	11.6
0	.6	35	12.4	8.1	9.4	14.9	7.1	3.6	48	1.20	24.9
0	.5	28	11.7	8.0	9.6	15.1	6.1	3.1	40	1.20	17.2
0	.4	32	12.9	8.2	9.6	17.6	12.5	3.3	71	1.80	35.2
0	.3	31	12.0	8.1	9.3	16.8	9.1	2.4	54	1.70	24.9
0	1.5	3	17.8	8.0	8.5	27.7	.7	3.4	3	.07	1.1
0	1.0	6	18.7	7.9	8.4	26.2	.8	3.2	3	.07	1.1
0	.6	19	19.3	8.0	8.5	26.6	1.4	2.7	5	.08	1.2
0	.5	44	15.8	7.8	8.9	21.2	1.6	1.7	7	.09	1.0
0	.3	35	13.9	8.0	9.0	18.4	2.4	1.6	13	.10	1.4
0	.3	28	16.2	7.9	8.9	20.0	3.7	1.9	19	.15	1.6
54	1.9	0	10.1	7.3	7.9	22.5	.2	1.9	1	.04	1.0
46	1.6	0	11.3	6.8	7.3	23.4	.2	1.3	1	.04	.5
42	1.3	0	12.1	7.4	8.0	23.9	.2	1.3	1	.04	.5
45	.7	0	10.7	7.5	8.0	20.6	.2	.9	1	.04	.5
48	.7	0	10.4	7.6	8.0	20.4	.2	.7	1	.05	.5
66	.4	20	8.3	7.8	8.7	14.3	.2	.4	1	.03	.5
1	1.1	20	7.6	7.8	8.9	16.2	.2	2.0	1	.03	.8
1	.8	25	8.2	7.6	8.9	14.9	.2	1.0	1	.03	.7
1	.6	33	8.4	7.7	8.9	11.8	.2	.6	1	.03	.6
1	.4	40	7.3	8.0	9.2	9.3	.2	.5	2	.03	.4
1	.2	37	7.8	7.9	9.3	10.1	.3	.7	2	.03	.5
0	.1	30	7.2	8.2	9.6	12.2	.7	1.5	6	.04	.8
0	1.5	2	14.6	7.7	8.7	25.4	1.1	5.5	4	.06	1.1
0	1.7	2	14.2	7.6	8.8	26.0	1.1	5.5	4	.07	1.1
0	.8	4	14.3	7.8	8.9	25.6	1.2	4.0	5	.06	.9
0	.6	27	14.4	7.8	9.3	19.9	1.4	3.0	7	.05	1.0
0	.3	28	12.1	7.9	9.4	17.5	1.4	3.1	8	.05	1.1
0	.3	35	11.7	8.0	9.3	17.1	1.4	3.2	8	.07	1.5
0	.1	31	12.8	7.8	9.3	18.3	1.5	3.4	8	.08	1.6
0	.2	32	14.8	8.0	9.3	17.5	1.1	1.8	6	.07	1.1
0	1.7	0	10.5	6.0	6.9	21.1	.3	1.5	0	.06	.9
0	1.1	0	12.3	6.0	7.0	21.7	.2	1.1	0	.04	.4
0	.9	0	15.2	6.0	7.1	24.6	.3	.7	0	.05	.3
0	.5	0	19.6	6.9	8.0	31.9	.5	.6	0	.08	.4
0	.3	2	19.1	7.4	8.6	31.1	.7	.6	2	.08	.5
0	.2	4	16.7	7.5	8.7	26.7	.7	.6	2	.07	.4
0	.1	15	17.9	7.4	8.7	28.6	.6	.7	2	.09	.7
0	4.0	2	17.4	8.0	9.0	29.4	4.8	3.0	16	.10	2.7
0	2.8	0	15.5	7.7	8.8	28.6	5.8	2.5	20	.20	4.1
0	1.5	0	14.8	7.9	9.0	25.4	7.2	2.7	28	.15	3.9
0	.9	2	17.7	8.0	9.4	27.6	10.3	3.3	37	.25	5.2
0	1.0	25	14.9	7.7	9.5	23.3	9.9	2.7	42	.35	8.9
0	.7	23	24.5	7.6	9.2	24.0	9.7	2.8	40	.50	10.9
0	.7	21	23.0	7.6	9.0	24.4	10.0	2.8	41	.60	12.3

TABLE 9.—*Laboratory analyses*

Soil	Horizon	Depth	Size class and diameter of particles							
			Total			Sand fraction				
			Sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay [2] (<0.002 mm.)	Very coarse sand (2.0–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)	Very fine sand (0.1–0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Gemson silty clay loam.	Ap1	0–4	19	52	29	0	0	1	4	14
	Ap2	4–8	8	59	33	0	0	1	4	3
	B21t	8–12	14	42	44	0	0	0	0	14
	B22t	12–16	16	44	40	0	0	1	1	14
	B23t	16–21	21	40	39	0	1	2	6	12
	B24tca	21–51	17	45	38	0	1	1	6	9
	B3ca	51–64	14	47	39	0	1	1	1	11
	C1ca	64–74	15	49	36	0	1	1	3	10
Hansel silt loam.	A11	0–6	20	57	23	0	1	1	3	15
	A12	6–10	10	65	25	0	1	0	1	8
	B21t	10–14	9	62	29	0	0	0	1	8
	B22t	14–18	6	57	37	0	0	0	1	5
	C1ca	18–23	4	58	38	0	0	0	1	3
	C2ca	23–33	12	57	31	0	1	1	3	7
	C3	33–45	6	66	28	0	0	1	2	3
	C4	45–62	3	62	35	0	0	0	1	2
Harding silt loam.	A11	0–2	16	68	16	1	0	1	2	12
	A12	2–5	20	67	13	0	1	0	3	16
	B2t	5–12	1	47	52	0	0	0	0	1
	B3tca	12–19	1	56	43	0	0	0	0	1
	C1ca	19–25	7	68	25	0	0	0	1	6
	C2ca	25–42	19	58	23	0	0	1	3	15
	C3	42–57	79	14	7	0	0	0	12	67
	C4	57–64	37	54	9	0	0	0	1	36
Hendricks silt loam.	Ap	0–6	8	72	20	0	0	0	1	7
	B1	6–11	15	60	25	0	0	0	1	14
	B21t	11–21	11	62	27	0	0	0	1	10
	B22t	21–38	9	65	26	0	0	0	1	8
	B23t	38–56	17	57	26	0	0	0	1	16
	B24tca	56–67	17	50	33	0	0	0	1	16
Honeyville silty clay loam.	Ap	0–8	4	61	35	0	0	0	1	3
	A12	8–13	4	61	35	0	0	0	1	3
	B21	13–19	3	60	37	0	0	0	1	2
	B22	19–32	3	59	38	0	0	0	1	2
	C1ca	32–40	3	59	38	0	0	0	1	2
	C2ca	40–64	1	60	39	0	0	0	0	1
Hupp gravelly silt loam.	A11	0–6	26	57	17	2	1	1	6	16
	A12	6–13	28	55	17	1	1	1	5	20
	A13	13–18	28	53	19	0	0	1	6	21
	B2	18–32	29	54	17	1	1	1	6	20
	Cca	32–51	27	57	16	0	1	1	6	19
Kapod stony loam.	A11	0–6	40	38	22	7	6	3	9	15
	A12	6–13	39	34	27	5	6	3	10	15
	B21t	13–18	46	26	28	9	8	5	11	13
	B22t	18–31	------	------	------	------	------	------	------	------
	C1ca	31–52	34	40	26	6	6	3	7	12
	C2	52–66	35	41	24	9	8	3	6	12
Kearns silt loam.	Ap	0–5	24	58	18	0	0	1	3	20
	A12	5–9	9	72	19	0	0	1	3	5
	B2	9–15	21	56	23	0	0	1	3	17
	C1ca	15–20	22	60	18	0	0	1	5	16
	C2ca	20–39	15	59	26	2	2	1	3	7
	IIC3ca	39–76	50	40	10	2	3	3	10	32

See footnotes at end of table.

of selected soils [1]—Continued

Coarse fragments (2 mm. to 3 inches)	Organic carbon	Calcium carbonate equivalent	Water content at 15 atmospheres	Reaction		Cation exchange capacity	Exchangeable bases (milliequivalents per 100 grams of soil)		Exchangeable sodium	Soluble salt (Bureau cup)	Electrical conductivity
				Saturated paste	1:5		Sodium	Potassium			
Percentage weight	*Percent*	*Percent*	*Percent*	*pH*	*pH*	*Meq per 100 gm of soil*			*Percent*	*Percent*	*Mmhos per cm at 25° C*
19	2.8	3	14.9	7.7	8.5	32.9	.4	2.5	1	.07	1.0
9	2.0	0	15.2	7.5	8.4	31.3	.3	1.7	1	.07	.9
5	1.3	0	16.6	7.4	8.3	32.1	.3	1.5	1	.07	.6
0	1.1	2	19.4	7.4	8.8	34.1	.8	1.1	2	.07	.6
0	.6	6	21.3	7.9	9.1	36.7	2.5	.8	7	.09	.5
0	.5	8	23.6	7.9	8.8	34.9	3.6	.7	10	.09	.6
15	.2	10	27.9	8.0	9.3	48.3	9.9	.7	20	.15	1.1
0	.4	43	34.6	8.1	9.4	48.1	11.1	.3	23	.15	1.5
0	1.9	0	13.6	7.3	8.3	26.8	.2	4.2	1	.07	.8
0	1.4	0	14.3	7.3	8.2	27.9	.2	2.8	1	.07	.6
0	1.3	1	16.5	7.2	8.2	28.8	.2	2.5	1	.10	1.3
0	1.0	12	18.5	7.5	8.5	26.5	.3	2.2	1	.10	1.1
0	.7	35	16.9	7.7	8.7	21.8	.3	1.6	2	.07	.8
0	.4	37	14.9	7.9	9.0	20.2	.9	1.8	4	.05	.7
0	.2	32	16.0	8.2	9.5	19.7	2.3	1.7	12	.06	.8
0	.2	26	16.3	8.3	9.7	22.5	5.1	1.8	23	.09	1.2
0	1.2	18	7.3	7.7	9.6	13.4	1.7	2.9	12	.07	2.6
0	.8	16	7.1	8.3	9.7	14.2	4.3	4.1	31	.20	7.1
0	.7	29	19.0	8.3	9.8	21.9	11.5	3.9	53	.70	11.1
0	.6	31	18.5	8.1	9.5	20.8	8.6	2.5	41	1.20	22.3
0	.3	25	12.5	8.0	9.3	15.2	7.7	1.9	51	1.80	36.1
0	.2	21	10.9	7.9	9.6	14.1	6.9	1.6	49	1.80	41.4
0	.1	8	7.2	8.2	9.8	18.7	4.9	1.3	26	.30	15.8
0	.1	7	4.6	7.9	9.7	12.9	7.9	2.2	61	.55	22.4
0	1.4	0	9.3	6.7	7.1	19.3	.2	1.7	1	.05	8
0	.9	0	12.7	6.8	7.5	20.7	.2	1.6	1	.05	.4
0	.7	0	13.7	6.5	7.5	20.9	.3	1.2	1	.05	.4
0	.5	0	13.9	6.8	7.7	21.3	.3	.6	1	.05	.3
0	.4	0	12.8	7.0	7.9	19.8	.4	.4	2	.04	.3
0	.3	1	17.7	6.8	8.5	27.9	1.1	.5	4	.08	.6
0	1.5	4	16.4	7.7	8.4	27.3	.5	2.3	2	.06	2.1
0	1.3	5	16.8	7.5	8.6	25.5	.7	2.3	3	.07	1.0
0	.8	8	17.1	7.6	8.6	28.3	.8	2.2	3	.06	.8
0	.6	15	16.7	7.7	8.4	21.1	1.0	2.1	5	.06	.8
0	.3	24	16.1	8.1	8.4	19.7	3.4	2.1	17	.08	1.4
0	.2	26	16.9	8.4	9.8	15.9	5.6	1.5	35	.15	1.4
0	3.8	0	12.0	7.4	7.8	23.0	.2	1.9	1	.04	1.3
0	2.0	1	10.1	7.6	7.8	21.4	.2	1.2	1	.04	.7
0	1.9	1	9.7	7.6	8.0	20.8	.2	1.4	1	.03	.6
0	.9	6	9.3	7.6	8.2	17.0	.2	1.0	1	.03	.5
0	.6	9	9.6	7.8	8.6	16.0	.3	.9	2	.03	.5
20	2.4	0	11.7	6.6	7.8	23.5	.2	1.5	1	.04	1.1
35	2.1	0	15.2	6.7	8.0	26.7	.2	1.3	1	.04	.6
31	1.5	5	15.5	7.1	8.0	26.8	.2	1.0	1	.05	.6
61	1.0	12	17.9	7.4	8.3	30.0	.2	.8	1	.07	.6
59	.3	36	13.3	7.7	8.6	22.6	.2	.7	1	.05	.5
37	.2	35	13.5	7.7	8.7	23.9	.3	.5	1	.05	.4
0	1.1	1	11.9	7.7	8.6	23.9	.2	2.7	1	.06	.9
0	1.1	1	12.7	7.4	8.3	24.6	.2	2.7	1	.04	.4
0	.8	12	15.3	7.9	8.9	24.4	.3	1.9	1	.05	.6
0	.5	18	14.4	7.9	9.0	21.0	.5	2.1	3	.06	.9
0	.3	14	10.2	8.2	9.5	16.5	1.8	2.1	11	.06	1.4
0	.2	14	8.0	8.7	9.8	12.8	3.6	1.5	27	.05	1.2

TABLE 9.—*Laboratory analyses*

Soil	Horizon	Depth	Size class and diameter of particles: Total: Sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay [2] (<0.002 mm.)	Sand fraction: Very coarse sand (2.0–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)	Very fine sand (0.1–0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Kirkham silt loam.	A11	0–5	23	53	24	0	0	0	7	16
	A12	5–10	33	49	18	0	0	0	11	22
	C1	10–16	43	44	13	0	0	0	11	32
	A1b1	16–25	7	57	36	0	0	1	2	4
	C2g	25–36	5	59	36	0	0	0	1	4
	A1b2g	36–44	4	53	43	0	0	0	1	3
	C3g	44–54	9	60	31	0	0	0	1	8
	C4g	54–68	9	57	34	0	0	1	2	6
Lasil silt loam.	Ap1	0–6	9	68	23	0	0	0	1	8
	Ap2	6–9	8	69	23	0	0	0	1	7
	B21t	9–13	7	63	30	0	0	0	0	7
	B22tca	13–19	9	57	34	0	0	0	2	7
	B3ca	19–23	8	59	33	0	0	0	2	6
	C1ca	23–36	7	54	39	0	0	0	1	6
	C2	36–44	8	61	31	0	0	0	2	6
	IIC3	44–60	6	58	36	0	0	0	1	5
Manila loam.	A11	0–5	17	58	25	0	1	1	3	12
	A12	5–13	15	57	28	1	1	1	2	11
	B1	13–20	16	56	28	0	1	1	2	12
	B21t	20–25	10	49	41	0	1	0	1	8
	B22t	25–32	7	40	53	0	0	0	1	6
	B23t	32–42	9	46	45	0	0	0	1	8
	IIC1ca	42–57	23	60	17	1	2	2	5	13
Mellor silt loam.	A11	0–3	8	69	23	0	0	0	1	7
	A12	3–6	8	69	23	0	0	0	1	7
	B21t	6–10	5	66	29	0	0	0	1	4
	B22t	10–14	3	62	35	0	0	0	0	3
	B3ca	14–18	3	60	37	0	0	0	0	2
	C1ca	18–25	2	56	42	0	0	0	0	2
	C2	25–41	3	61	36	0	0	0	1	2
	C3	41–48	3	66	31	0	0	0	1	2
	IIC4	48–62	71	19	10	15	15	13	17	11
Middle cobbly silt loam.	A11	0–3	20	60	20	0	1	2	6	11
	A12	3–7	24	57	19	1	3	2	5	13
	B21	7–12	22	56	22	1	2	2	5	12
	B22	12–19	23	53	24	0	2	2	5	14
	Clca	19–28	35	37	28	2	6	5	10	12
Palisade silt loam.	A1	0–6	34	53	13	0	1	2	10	21
	B2	6–12	37	49	14	0	1	2	11	23
	C1ca	12–19	47	42	11	0	1	2	15	29
	C2ca	19–30	56	36	8	0	1	2	18	35
	C3	30–43	72	24	4	0	2	2	23	45
	C4	43–53	74	19	7	0	1	2	41	30
Payson silt loam.	A2p	0–5	24	61	15	0	0	0	3	21
	B2t	6–14	16	35	49	0	0	0	5	11
	C1ca	14–17	21	41	38	0	3	5	5	8
	C2	17–24	32	46	22	0	1	1	18	12
	C3	24–32	24	54	22	0	0	0	3	21

See footnotes at end of table.

of selected soils [1]—Continued

Coarse fragments (2 mm. to 3 inches)	Organic carbon	Calcium carbonate equivalent	Water content at 15 atmospheres	Reaction		Cation exchange capacity	Exchangeable bases (milliequivalents per 100 grams of soil)		Exchangeable sodium	Soluble salt (Bureau cup)	Electrical conductivity
				Saturated paste	1:5		Sodium	Potassium			
Percentage by weight	*Percent*	*Percent*	*Percent*	*pH*	*pH*	*Meq per 100 gm of soil*			*Percent*	*Percent*	*Mmhos per cm at 25° C*
0	3.3	20	14.4	7.1	8.9	22.9	.6	3.0	3	.09	2.0
0	1.4	22	10.3	7.3	9.6	15.6	1.7	2.5	11	.09	2.3
0	.6	21	7.5	7.5	9.8	11.1	2.5	2.1	23	.20	5.9
0	2.3	35	19.9	7.8	9.6	24.9	3.2	2.9	13	.35	10.9
0	1.7	34	19.5	7.8	9.6	23.6	.4	2.7	2	.25	5.8
0	2.0	30	21.1	7.9	9.2	27.2	2.9	2.8	11	.25	4.7
0	.9	24	14.8	8.0	9.4	19.8	2.2	2.3	11	.10	1.9
0	.8	38	16.3	7.8	9.2	16.8	1.5	2.4	9	.15	3.9
0	2.1	0	13.0	7.4	8.3	24.9	.5	6.8	22	.09	2.8
0	1.5	0	14.3	7.4	8.1	24.3	3.1	4.0	13	.25	6.6
0	.8	0	14.7	7.4	8.7	24.4	8.0	4.3	33	.45	9.8
0	.5	11	20.4	7.8	9.2	24.6	14.0	5.0	56	.75	16.4
0	.5	26	18.0	7.9	9.5	20.5	12.7	3.9	63	.75	16.4
0	.4	25	18.0	7.7	9.2	21.6	10.2	3.2	47	.65	14.0
0	.4	18	16.5	7.7	9.1	22.2	10.0	2.9	45	.75	16.4
0	.4	22	16.8	7.6	8.9	20.8	9.0	2.0	43	.80	19.7
18	2.5	0	11.8	6.4	7.9	24.4	.2	1.4	1	.03	.6
11	2.1	0	13.9	6.5	7.5	25.3	.2	1.6	1	.04	.6
12	1.6	0	12.6	6.5	7.8	23.2	.2	.9	1	.04	.5
14	.9	0	16.8	6.6	7.6	28.2	.3	.7	1	.06	.4
0	.8	0	23.0	7.0	8.0	39.6	.3	.8	1	.09	.5
15	1.1	0	19.0	7.0	7.9	32.3	.3	.6	1	.07	.6
40	1.1	17	16.1	7.4	8.6	25.8	.4	.5	1	.07	.9
0	1.4	11	9.9	8.0	9.6	18.5	2.8	5.0	15	.15	4.9
0	1.0	9	10.7	7.7	9.4	19.7	4.2	4.0	21	.35	12.1
0	.7	8	13.9	7.7	9.3	20.4	9.5	3.8	46	.90	25.9
0	.6	19	18.0	7.7	9.3	21.1	10.2	3.1	48	.70	27.2
0	.7	27	21.2	7.7	9.2	20.6	7.7	2.0	37	.30	30.1
0	.5	34	23.9	7.8	9.2	19.0	6.8	1.2	36	.80	32.0
0	.4	28	19.5	7.6	9.2	19.6	8.0	1.0	41	.70	32.0
0	.3	24	18.7	7.7	8.5	18.5	7.3	.8	40	.15	32.0
0	.3	43	8.3	7.8	8.8	7.3	2.2	.3	30	.15	30.1
38	2.6	0	10.9	7.5	8.1	22.6	.1	1.5	1	.04	.9
50	2.8	2	11.5	7.5	8.3	25.6	.2	1.0	1	.04	.9
32	2.7	2	12.6	7.6	8.2	26.6	.2	.8	1	.04	1.3
38	2.4	4	13.6	7.3	8.1	26.8	.2	.8	1	.05	1.0
43	1.0	38	13.2	7.5	8.5	17.9	.2	.4	1	.05	.7
0	1.1	11	8.4	8.0	8.7	16.6	.3	3.8	2	.03	.9
0	.6	15	9.9	8.3	8.7	16.5	.5	3.1	3	.04	.7
0	.4	20	7.8	8.4	9.1	13.1	2.1	2.1	16	.10	1.0
0	.3	24	6.9	8.6	9.7	10.3	3.8	1.6	37	.40	9.2
0	.2	20	5.4	8.5	9.8	9.0	4.9	1.1	55	.45	12.5
0	.1	15	4.8	8.2	9.8	8.0	4.1	1.0	51	1.80	16.1
0	.9	0	0	6.7	7.5	11.6	0	0	0	.07	2.8
0	.8	4	0	8.0	8.9	28.3	7.3	0	26	.23	2.8
0	.4	39	0	8.3	9.7	19.2	7.0	0	36	.41	7.2
0	.2	23	0	8.4	9.7	15.6	4.6	0	30	.57	9.5
0	0	21	0	8.2	9.6	15.4	8.6	0	56	.11	18.2

TABLE 9.—*Laboratory analyses*

Soil	Horizon	Depth	Size class and diameter of particles							
			Total			Sand fraction				
			Sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay [3] (<0.002 mm.)	Very coarse sand (2.0–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)	Very fine sand (0.1–0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Placeritos silt loam.	Ap	0–6	1	59	40	0	0	0	0	1
	A1	6–11	1	64	35	0	0	0	0	1
	A12	11–16	7	60	33	0	0	0	0	7
	A1b	16–22	20	53	27	0	0	0	2	18
	C1	22–31	24	56	20	0	0	0	1	23
	C2	31–43	53	35	12	0	0	0	5	48
	C3	43–51	31	54	15	0	0	0	3	28
	C4	51–62	59	31	10	0	0	0	9	50
Pogal silt loam.	A11	0–4	24	64	12	0	0	0	1	23
	A12	4–13	24	64	12	0	0	0	1	23
	C1	13–22	21	67	12	0	0	0	1	20
	C2ca	22–35	26	64	10	0	0	0	1	25
	C3	35–41	25	61	14	0	0	0	1	24
	C4	41–49	26	61	13	0	0	0	1	25
	C5	49–60	26	64	10	0	0	0	1	25
Pomat silt loam.	A1p	0–5	33	48	19	0	2	5	6	20
	A12	5–10	40	42	18	0	3	2	11	24
	C1	10–25	33	54	13	0	0	1	5	27
	C2	25–56	12	72	16	0	0	1	5	6
	C3	56–65	66	25	9	1	12	16	23	14
Red Rock silt loam.	Ap	0–9	9	73	18	0	0	0	1	8
	A12	9–17	5	70	25	0	0	0	1	4
	B1	17–25	6	68	26	0	0	0	1	5
	B2	25–37	8	65	27	0	0	0	1	7
	C1	37–48	10	66	24	0	0	0	2	8
	C2	48–66	10	68	22	0	0	0	2	8
	C3	66–84	11	65	24	0	0	1	2	8
Sandall cobbly silt loam.	A11	0–2	17	59	24	2	1	1	3	10
	A12	2–7	17	57	26	1	1	1	3	11
	B2	7–16	20	53	27	1	1	1	4	13
	C1ca	16–24	30	44	26	2	3	2	8	15
	C2ca	24–35	40	36	24	3	4	4	13	16
Sanpete gravelly silt loam.	Ap	0–5	26	56	18	7	4	1	3	11
	A12	5–10	31	49	20	12	5	2	3	9
	B2	10–19	45	37	18	19	8	4	5	9
	C1ca	19–31	55	32	13	18	13	4	7	13
	C2ca	31–41	37	55	8	5	5	3	7	17
	C3	41–56	25	64	11	3	2	1	5	14
	C4	56–65	47	44	9	14	7	4	7	15
Stingal loam.	Ap1	0–2	38	47	15	0	0	0	7	31
	Ap2	2–6	37	47	16	0	0	0	7	30
	B21	6–13	43	44	13	0	0	0	9	34
	B22	13–25	48	39	13	0	0	0	10	38
	C1ca	25–34	46	43	11	0	0	0	9	37
	C2ca	34–48	46	44	10	0	0	0	8	38
	C3ca	48–56	62	32	6	0	0	0	14	48
	C4	56–74	63	31	6	0	0	0	12	51
Stokes silt loam.	Ap1	0–6	22	56	22	0	0	0	7	15
	Ap2	6–11	23	55	22	0	0	0	7	16
	B21t	11–18	16	38	46	0	0	1	6	9
	B2tca	18–24	6	53	41	0	0	0	1	5
	C1ca	24–47	7	63	30	0	0	0	1	6
	C2	47–68	12	63	25	0	0	0	2	10

See footnotes at end of table.

of selected soils [1]—Continued

Coarse fragments (2 mm. to 3 inches)	Organic carbon	Calcium carbonate equivalent	Water content at 15 atmospheres	Reaction		Cation exchange capacity	Exchangeable bases (milliequivalents per 100 grams of soil)		Exchangeable sodium	Soluble salt (Bureau cup)	Electrical conductivity
				Saturated paste	1:5		Sodium	Potassium			
Percentage by weight	*Percent*	*Percent*	*Percent*	*pH*	*pH*	*Meq per 100 gm of soil*			*Percent*	*Percent*	*Mmhos per cm at 25° C*
0	2.1	24	22.1	7.1	8.6	24.3	6.4	2.0	26	.30	5.5
0	1.1	25	19.1	7.5	9.1	22.0	4.9	1.7	22	.25	5.5
0	1.4	24	20.6	7.1	9.1	22.4	5.5	1.8	25	.70	15.1
0	2.1	22	20.1	7.7	9.3	22.1	7.7	1.7	35	.10	21.7
0	.3	22	11.6	7.9	9.5	13.1	6.8	1.3	52	.70	30.1
0	.2	23	6.3	7.9	9.4	9.4	2.6	.9	28	.50	38.3
0	.3	20	9.2	7.7	9.2	12.3	6.4	1.2	52	.20	44.7
0	.2	18	5.7	7.5	9.1	9.7	5.3	1.1	55	2.00	41.8
0	1.6	20	6.4	7.8	8.5	11.0	.2	.8	2	.04	1.1
0	.6	20	5.0	7.6	9.1	8.4	.4	2.1	5	.15	6.4
0	.4	21	6.3	8.1	9.7	9.0	3.4	2.6	38	.60	18.1
0	.2	18	4.9	8.5	10.0	7.4	4.1	2.4	56	.15	18.1
0	.2	26	5.9	8.5	10.0	7.4	5.2	1.6	70	.80	20.1
0	.2	25	6.4	8.4	9.9	8.1	5.9	1.4	73	.45	23.6
0	.1	21	5.5	8.3	9.9	8.6	5.7	1.5	66	.70	25.9
0	1.0	22	14.2	7.9	8.9	22.0	.3	2.1	1	.03	.5
0	1.0	24	15.1	7.8	8.8	21.7	.2	1.7	1	.04	.5
0	.3	23	14.3	7.9	9.2	19.5	1.1	1.1	6	.04	.6
0	.2	22	15.3	8.5	9.8	20.1	7.8	1.8	39	.09	2.1
0	.4	43	20.8	8.6	9.9	19.0	8.4	1.4	44	.10	2.3
0	1.6	1	12.9	7.7	8.7	26.6	.3	3.7	2	.06	.8
0	2.1	0	17.0	7.4	8.2	33.6	.2	3.5	1	.08	1.1
0	1.8	0	16.1	7.2	8.0	22.5	.2	3.2	1	.10	1.4
0	1.2	0	16.8	7.3	8.2	31.4	.2	3.0	1	.09	.9
0	.9	0	16.2	7.4	8.4	30.9	.3	3.0	2	.09	1.1
0	.6	6	15.4	7.7	8.9	27.5	1.0	3.0	4	.08	1.0
0	.5	6	15.3	7.8	9.0	27.2	1.1	3.1	4	.07	.9
0	3.5	14	16.9	7.6	8.7	27.0	.4	1.7	1	<.03	2.3
0	2.5	15	15.8	7.2	8.7	26.0	.4	1.5	2	.09	1.7
0	1.3	19	15.2	7.3	8.9	21.4	2.1	1.1	10	.15	6.6
0	1.5	32	14.9	7.4	9.0	19.4	3.5	.7	18	<.03	11.6
0	1.1	65	20.6	7.6	9.0	15.0	3.9	.3	26	.08	17.0
0	1.6	14	9.5	7.6	9.0	20.0	.4	3.3	2	.05	1.8
0	1.4	15	11.2	7.7	8.9	20.1	.4	1.5	2	.04	1.0
0	1.1	28	9.7	7.5	9.1	13.4	.6	.6	4	.05	1.3
0	.6	51	6.2	7.6	9.4	6.0	.5	.2	10	.04	1.9
0	.4	50	5.9	8.5	10.0	6.5	2.0	.7	30	.08	2.3
0	.1	45	5.6	8.9	10.3	6.1	2.9	.8	48	.08	2.3
0	.1	37	4.6	9.0	10.4	5.8	3.2	.6	55	.07	2.3
0	1.2	7	8.9	7.7	9.0	17.9	.5	3.9	3	.05	1.8
0	1.0	8	8.9	7.9	9.2	17.9	.5	3.5	3	.03	.9
0	.7	16	9.9	7.7	9.0	15.9	.8	1.6	5	.03	.7
0	.5	22	9.3	7.9	9.1	13.5	.6	1.4	5	.03	.8
0	.3	32	7.7	8.3	10.0	11.2	2.5	2.9	23	.10	2.9
0	.2	31	6.9	9.2	10.4	11.2	5.6	3.5	50	.10	3.5
0	.2	32	6.1	9.2	10.4	10.2	5.1	2.4	50	.15	3.7
0	.2	34	6.0	8.9	10.2	10.1	4.7	1.9	47	.06	5.4
0	.9	1	7.9	7.8	8.8	15.3	.5	3.0	3	.04	1.1
0	.8	1	7.6	7.9	9.1	14.5	1.2	3.0	8	.05	1.8
0	.6	10	24.5	8.2	9.7	24.8	11.7	3.2	47	.25	3.6
0	.4	36	21.8	9.1	10.1	19.6	16.5	3.6	84	.55	5.5
0	.1	33	14.5	9.1	10.2	17.8	13.4	2.7	75	.35	5.6
0	0	18	12.0	8.9	10.0	15.8	12.3	2.6	78	.25	3.7

TABLE 9.—*Laboratory analyses*

Soil	Horizon	Depth	Size class and diameter of particles: Total: Sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay [2] (<0.002 mm.)	Sand fraction: Very coarse sand (2.0–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)	Very fine sand (0.1–0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Thiokol silt loam.	Ap	0–5	12	64	24	0	0	0	2	10
	A1	5–9	10	65	25	0	0	0	2	8
	B21	9–13	11	63	26	0	0	0	1	10
	B22	13–20	12	63	25	0	0	0	2	10
	C1ca	20–28	12	60	28	0	1	1	3	7
	C2ca	28–36	20	64	16	0	2	3	5	10
	C3	36–60	10	77	13	0	1	1	2	6
Yeates Hollow cobbly clay loam.	A1	0–8	20	47	33	0	1	1	5	13
	B21t	8–14	18	40	42	1	1	1	5	10
	B22t	14–19	15	36	49	1	1	1	3	9
	B23t	19–32	10	17	73	0	1	1	2	6

[1] All analyses were made on fractions of less than 2 millimeters except the coarse fragment determinations.

Cation exchange was determined by the sodium acetate method, using a flame photometer to measure the absorbed sodium.

Additional Facts About Box Elder County, Eastern Part

This section describes the early settlement and development; physiography, relief, and drainage; water supply and farming; and climate in the survey area.

Early Settlement and Development

The early inhabitants in this region were desert-culture Indians who lived on seeds, roots, berries, and small game. Indian caves on the southern side of the Promontory Mountains remain to this day. The Navajo Indians were some of the first, but Shoshoni and Ute Indians later occupied and used this area as a hunting ground.

The first white men to explore the area were fur trappers. Weber's party, of the Rocky Mountain Fur Company, trapped beaver in the winter of 1824. Jim Bridger, a member of this party, followed the Bear River to the Great Salt Lake. When he tasted the water, he thought that he had discovered an arm of the Pacific Ocean. John C. Fremont and party were the first white men known to have explored any of the lake islands.

The area was colonized by the Mormons (members of the Church of Jesus Christ of Latter-Day Saints). In 1851, eight families gathered in the settlement that is now known as Brigham City. Three years later, Lorenzo Snow and his colony of 50 families settled in this area. During the next few years, many of the small communities in the valley, such as Corinne, Bear River City, and Tremonton, were settled. (The land before settlement was described as a panorama of sagebrush and waving bunchgrass.) In 1858, the first peaches were grown in Brigham City. The first nonirrigated wheat was grown near Honeyville in 1863. That season some 400 bushels of wheat were matured without irrigation water. Today, approximately 35 percent of the nonirrigated wheat in the State is grown in the survey area.

The Bear River Migratory Bird Refuge, 17 miles west of Brigham City, is the largest of its kind in the world. Fresh-water ponds were formed by construction of dikes. Millions of migratory birds visit here each year for nesting and feeding.

The Golden Spike, which completed the transcontinental railroad, was driven on May 10, 1869, at Promontory Summit. This spot, now declared a National Historic Site, is located about 25 miles west of Brigham City.

A recent development is the pumping of mineral-heavy water across Promontory Point to a network of evaporative ponds. Thus, important minerals are produced by evaporating the mineral-rich water of Great Salt Lake from this series of solar ponds and dikes in the area.

Physiography, Relief, and Drainage

Box Elder County, Eastern Part, is in the Middle Rocky Mountain and Basin and Range physiographic provinces (*5*). The Wasatch Range is a part of the Middle Rocky Mountain Province. These mountains trending north and south make up the eastern part of the survey area. Elevations of the Wasatch Mountains in this area range from about 5,200 to 8,900 feet. The most striking element in the topography of this range is the abrupt, wall-like western front, which is approximately 5,000 feet from base to top. At intervals of a few miles, this steep

of selected soils [1]—Continued

Coarse fragments (2 mm. to 3 inches)	Organic carbon	Calcium carbonate equivalent	Water content at 15 atmospheres	Reaction		Cation exchange capacity	Exchangeable bases (milliequivalents per 100 grams of soil)		Exchangeable sodium	Soluble salt (Bureau cup)	Electrical conductivity
				Saturated paste	1:5		Sodium	Potassium			
Percentage by weight	*Percent*	*Percent*	*Percent*	*pH*	*pH*	*Meq per 100 gm of soil*			*Percent*	*Percent*	*Mmhos per cm at 25° C*
0	1.6	10	13.8	7.7	8.8	29.0	.3	3.8	1	.05	.8
0	1.6	10	14.1	7.6	8.7	29.7	.3	3.0	1	.04	.6
0	1.3	11	15.4	7.6	8.7	28.6	.2	2.1	1	.05	.6
0	1.2	16	16.2	7.7	8.8	27.7	.5	1.8	2	.05	.6
0	.6	40	13.1	7.9	9.4	19.9	2.4	1.6	12	.06	1.0
0	.4	37	13.4	8.2	9.5	20.6	3.8	2.0	18	.06	1.0
0	.2	24	15.1	8.4	9.7	24.9	5.9	2.2	24	.09	1.2
20	3.1	0	14.3	6.7	8.0	29.0	.2	1.6	1	.04	.7
16	2.5	0	19.1	6.4	8.0	34.2	.2	1.0	1	.06	.7
22	1.8	0	21.0	6.6	7.5	36.9	.3	.8	1	.08	.7
29	1.6	0	33.8	6.6	7.7	59.5	.5	1.1	1	.08	.5

[2] Determinations of percentage of clay include mineral clay and calcium carbonate particles of clay size.

face is intercepted by canyons branching headward, subdividing the slope into ridges or long lines of peaks.

The Wasatch Range as it occurs in the survey area consists of limestone, shale, and Brigham quartzite of the Cambrian period and gneiss and schist of the Archean period (*2*). The Brigham quartzite shows remarkable variations in thickness; it is 1,000 to 1,500 feet thick near Willard and is several thousand feet thick near Brigham City. Conglomerate bands in the upper part of this quartzite formation consist mainly of rounded quartzite pebbles with occasional pieces of gneiss. The mountains east of Willard show a particularly good exposure of the sequence of these formations. Here, the Cambrian quartzite rests on the Archean gneiss and schist and is overlain by thick bands of limestone and shale.

The remaining part of the survey area lies in the Basin and Range physiographic province. This makes up the entire area in Box Elder County from the base of the Wasatch Mountains west to the survey boundary, a distance of about 55 miles. Most of this area is within the limits of ancient Lake Bonneville, a prehistoric inland lake of Pleistocene time (*3*). When Lake Bonneville occupied this area, the southern end of the Promontory Range and the Blue Spring Hills were islands. The topography of this area consists of a series of relatively low, rounded mountains that extend from north to south and are separated by broad intervening valleys. These valleys include the main drainageways of the area, which are the Bear River, Malad River, and Blue Creek, all of which drain southward into Great Salt Lake. The outstanding topographic characteristic of the area is a series of old Lake Bonneville terraces that appear as well-worn, giant steps up the sides of the mountains. The treads of these steps and the valley floors constitute the larger part of the cultivated land in the survey area.

Along the mountain sides and on alluvial slopes are escarpments, terraces, and beachbars. These shore features were formed at every level at which the lake stood long enough to produce them. The most prominent of these shore features are the two terraces known as the Bonneville and Provo levels, about 1,000 and 600 feet, respectively, above Great Salt Lake. The alkali flats and desert areas in western parts of the survey represent the floor of this ancient lake.

Because of its dominant size, the Provo terrace (or delta) is the most easily recognized. It is roughly 400 feet below the Bonneville terrace. Perhaps at no other place are deltas better preserved than within the marginal area of the region covered by the waters of Lake Bonneville, especially the eastern part along the base of the Wasatch Mountains. These large deltas have been deeply transected by the streams that made them, and in recent years they have been extensively worked for sand and gravel used in construction. The large delta near Brigham City is the most extensive source of high-grade sand and gravel in this region.

Water Supply and Farming

The main source of irrigation water is the Bear River. The water is impounded by Cutler Dam, which is owned by the Utah Power and Light Company, and is used for generating power. The power company has agreed to furnish 900 second-feet of water during the irrigation season. This irrigation water is delivered through two major canals. The West Side Canal delivers 735 second-feet of water to the farmland in a canal system some 79 miles long. Water was first delivered by this canal in 1894. In 1901, the Utah-Idaho Sugar Company acquired the entire system and spent over a million dollars to bring the system virtually to its present condition. The East Side Canal has 41 miles of main canal and delivers 165 second-feet of water. The entire 120 miles of main canal is owned and operated by the Utah-Idaho Sugar Company.

The Bear River supplies an abundance of good-quality water at a reasonable rate. The water is delivered to the farmers on a turn basis. In recent years, several miles of farm ditches and main laterals have been lined with concrete to conserve water and reduce maintenace. In addition, hundreds of acres of irrigated soils have been leveled.

Sugar beets are the most important irrigated crop. In 1902, the first sugar beets grown in this area had to be shipped some 100 miles away to be processed. This area has the largest acreage of sugar beets in the State. Today, about 10,500 acres of sugar beets, or one-third of the total production in the State, is grown in the survey area. The Garland sugar factory, located in the heart of this irrigated valley, was built in 1903. This is one of the two remaining sugar factories in Utah today. All the sugar beets grown in Utah and southern Idaho by the Utah-Idaho Sugar Company are being processed at the Garland factory. The plant employs many people in the fall and winter months.

Tomatoes are another important crop. According to the latest agricultural census, tomatoes are grown on 780 acres in the survey area, and this is one-third of the total acreage of the crop grown in Utah.

Part of the storage in Pine View Reservoir, some 30 miles to the south of Brigham City, is delivered by the Ogden-Brigham Canal to irrigate the orchards near Brigham City. The low-stage stream flows from the Malad River are high in content of salts. Only a few acres are irrigated along the Malad River flood plain. Most of this area is used for native pasture, which is grazed or cut for hay.

Major exploration and development of wells is underway in the Curlew Valley. Some 6,500 acres are presently irrigated from pump wells. The short growing season limits the kind of crops that can be grown successfully. The short frost-free period in this area limits the suitable crops to irrigated alfalfa, alfalfa seed, small grain, irrigated pasture, and some corn for silage.

Many acres of the Bear River Valley are too wet for maximum crop production. Drainage is needed to lower the water table and reduce the concentration of salts. For the most part, tile drains are installed on these soils. Most of the irrigated cropland has been drained by individual farm drains. The deeply entrenched stream channels that dissect the valley provide good outlets for many of these drains. Large drainage districts have also been organized to assist in draining these wet lands. The Corinne Drainage District, organized in 1915 to serve 11,000 acres, is the oldest. The Elwood Drainage District was set up to serve some 3,000 acres.

The Iowa String Drain was completed in 1969. This drain was installed to provide an outfall line for the individual farms. The Iowa String Drainage District was organized to serve about 2,900 acres. Additional drains of this type are being planned in the area.

Three manmade reservoirs are in the survey area. In the mountain valley of Mantua is the Mantua Reservoir, which is used for municipal water supply and furnishes recreation for boating and fishing. The Willard Bay Reservoir, having a storage capacity of 193,000 acre-feet, is by far the largest. It is on the lake plain just west of Willard. The water is stored but not used in the survey area. The stored water is pumped into canals and used entirely in the two counties to the south. The Blue Creek Reservoir is just below the Blue Creek Springs. The springs have a steady flow of about 10 cubic feet per second. This 2,000 acre-feet facility stores flow from the springs during winter. The stored water is used to supplement the natural flow of the springs during the irrigation season and irrigates about 3,000 acres of alfalfa and small grain in the Howell Valley.

Climate of Box Elder County, Eastern Part [7]

Box Elder County, Eastern Part, lies along the northern end of Great Salt Lake at an elevation that ranges from the 4,200 feet at the lake to more than 9,000 feet in the Wellsville Mountains along the eastern boundary. Much of the southwestern part of the area is covered by the brine water of the lake or the marshes that lie along the shore. A series of north-south oriented hills and valleys covers most of the rest of the area.

These topographic features have a strong modifying influence on the climate of the survey area. The annual precipitation ranges from 6 inches over and near the lake to a little more than 30 inches at the tops of the higher mountains. Thus, the precipitation shows a marked increase with increasing elevation. Data on temperature and precipitation are given in table 10 and are from records kept at Brigham City, Corinne, and Snowville. The probability, in percent, and probable dates of occurrence of freezing temperatures at these stations are shown in figure 19.

The presence of such a large body of water, which never freezes because of its high salt content, has a strong moderating effect on the temperatures of the survey area. This effect shows up best in the length of the growing season, which averages 180 days along the lakeshore and decreases with distance away from it. The average growing season in the bench areas is 140 to 160 days, but it is as low as 90 days in the bottoms of some northern valleys.

In general, the eastern part of the survey area has a semiarid, continental climate with four well-defined seasons. Summers are hot and dry, but the high temperatures are not oppressive, because the relative humidity during the warmer part of the day averages between 20 and 30 percent. Nights are usually cool, and even through the day the high temperature only occasionally exceeds 100° F. Maximum temperatures of 90° or higher occur on 30 to 40 days each summer. Most of the summer precipitation comes from thunderstorms that build up along the mountains. Thunderstorms are generally local in nature.

Hail in summer and spring occasionally causes damage to crops and property, but the damage is relatively small.

Winters are cold but are usually not severe. The Rocky Mountains to the east and northeast act as a barrier to invasions of cold continental air. Consequently, extended periods of extremely cold weather are rare. On the average, a minimum temperature below zero occurs less than 10

[7] ARLO RICHARDSON, climatologist for Utah, National Weather Service, U.S. Department of Commerce, assisted in preparing this section.

times a year. The average seasonal snowfall ranges between 12 and 50 inches in the areas below 5,000 feet, but in places it is as much as 80 inches along the higher benches and more than 175 inches in the higher mountains along the eastern border of the survey area.

There is marked variation in the seasonal precipitation, most of which falls in winter and spring. The wettest month is usually April or May, and midsummer is usually the driest part of the year.

Winds are generally light to moderate during all seasons, but strong damaging winds occasionally occur either as easterly winds blowing out of the canyons or as westerly winds associated with locally severe thunderstorms or cold fronts.

TABLE 10—*Temperatures and precipitation data*

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Two years in 10 will have at least 4 days with—: Maximum temperature equal to or higher than—	Two years in 10 will have at least 4 days with—: Minimum temperature equal to or lower than—	Precipitation: Average total	One year in 10 will have—: Less than—	One year in 10 will have—: More than—	Average snowfall
BRIGHAM CITY (ELEVATION 4,335 FEET)								
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Inches
January	35.8	18.0	49	2	1.99	0.53	3.52	16.0
February	41.8	23.0	58	8	1.59	.50	2.95	10.0
March	50.0	28.6	57	16	1.93	.80	2.98	6.9
April	61.0	37.2	76	28	2.34	.82	3.83	2.6
May	72.6	46.1	87	34	1.95	.43	3.32	[1]
June	80.8	53.2	94	44	1.90	.10	3.62	0
July	92.5	61.4	100	54	.34	[1]	1.16	0
August	89.8	59.0	98	48	.71	[1]	2.10	0
September	79.4	49.4	92	38	1.14	.05	2.86	[1]
October	66.2	39.5	81	30	1.49	.05	3.34	.6
November	49.6	29.6	64	17	2.03	.55	3.17	3.7
December	46.3	22.5	52	10	1.95	.57	3.24	12.4
Year	63.8	39.0	----------	----------	19.36	----------	----------	52.2
CORINNE (ELEVATION 4,230 FEET)								
January	36.6	13.4	48	−4	1.54	.33	2.78	10.4
February	41.6	19.4	56	4	1.30	.30	2.41	5.2
March	50.0	25.3	67	15	1.40	.39	2.33	2.4
April	62.2	33.7	77	25	1.70	.36	2.80	1.0
May	72.7	41.8	86	32	1.86	.30	3.01	0
June	80.8	47.9	94	40	1.49	0	2.35	0
July	92.2	55.2	99	47	.40	0	1.25	0
August	90.3	53.0	98	44	.60	0	1.75	0
September	80.5	43.3	92	33	.83	0	1.97	0
October	67.2	33.7	82	24	1.12	.15	2.71	.4
November	49.6	25.4	63	9	1.57	.05	2.62	1.8
December	38.9	18.6	49	6	1.72	.31	3.55	6.8
Year	63.6	34.2	----------	----------	15.53	----------	----------	28.0
SNOWVILLE (ELEVATION 4,560 FEET)								
January	34.6	10.0	45	−1	1.11	.32	2.17	10.9
February	39.1	15.2	53	−2	.77	.30	1.80	6.1
March	44.2	20.3	62	5	.70	.10	2.08	5.9
April	59.0	28.3	73	17	1.21	.39	2.16	1.6
May	66.4	36.4	84	27	1.57	.55	2.62	.2
June	78.0	42.4	93	32	1.48	.53	2.84	0
July	90.4	49.9	100	41	.44	.04	1.48	0
August	87.8	50.0	95	38	.70	0	1.46	0
September	79.9	41.6	90	27	.69	0	1.64	0
October	64.5	28.8	80	15	.63	.06	2.21	[1]
November	60.1	21.4	61	6	1.23	[1]	1.81	3.1
December	36.4	14.1	44	4	1.02	.30	2.08	7.4
Year	61.7	29.9	----------	----------	11.55	----------	----------	35.2

[1] Trace.

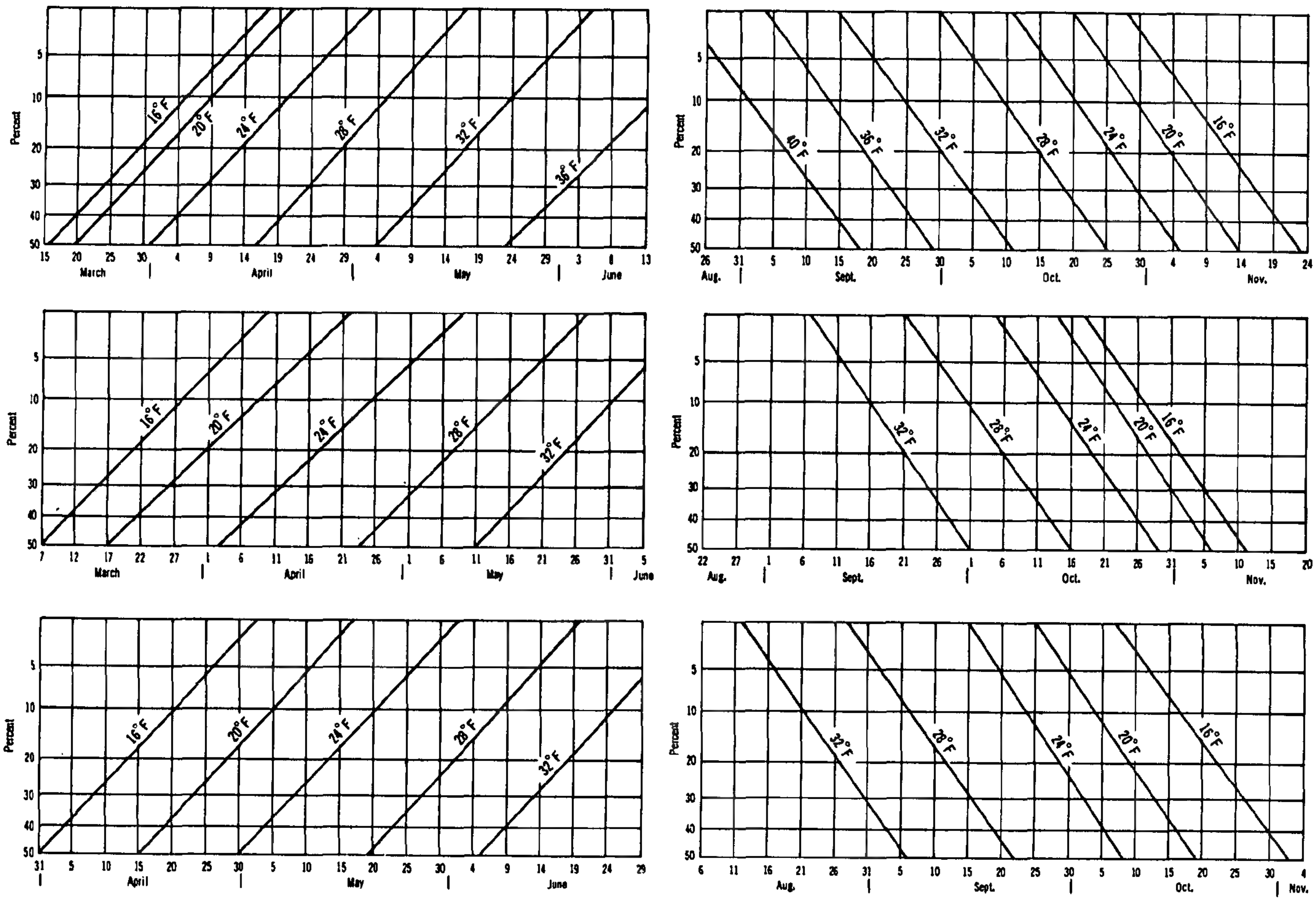

Figure 19.—Probabilities, in percent, and probable dates of last freezing temperatures in spring and the first in fall for three places in the survey area. The upper pair of charts is for Brigham City, the center pair is for Corinne, and the lower pair is for Snowville.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more

of the total exchangeable bases) or both, that the growth of most crop plants is low from this cause.

Alkaline soil. A soil that has a pH value greater than 7.0. See also Reaction, soil.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvial soil. Soil formed from alluvium and showing weak modification of the original material caused by soil-forming processes.

Alluvium. Soil material, such as gravel, sand, silt, or clay, that has been deposited on land by streams.

Available water holding capacity (also termed available water capacity or available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Border irrigation. See Irrigation.

Calcareous soil. A soil that contains calcium carbonate or lime. The following are terms used in this survey to describe calcareous soils, and the approximate amounts of calcium carbonate equivalent the soils contain:

Noncalcareous.—Less than 1 percent calcium carbonate equivalent.

Slightly calcareous.—1 to 3 percent calcium carbonate equivalent.

Moderately calcareous.—3 to 15 percent calcium carbonate equivalent.

Strongly calcareous.—15 to 40 percent calcium carbonate equivalent.

Very strongly calcareous.—More than 40 percent calcium carbonate equivalent.

Cemented (soil material). A brittle, hardened consistence, caused by a cementing substance, such as lime, silica, iron, or alumina. Some cementing agents resist moistening but soften under prolonged wetting. Some cemented soil layers soften readily when wet; other are still hard or brittle. A weakly cemented mass is brittle and hard; it can be broken in the hand. A strongly cemented mass is brittle; it is too hard to be broken in the hand but can easily be broken with a hammer. An indurated mass is very strongly cemented and brittle, does not soften under prolonged wetting and requires a sharp blow with a hammer to break it.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A dark-colored film of fine clay that coats the surface and pores of soil aggregates or peds in many strongly developed soils. Clay films occur predominantly in the B horizon and consist of clay leached from horizons above.

Cobblestone. Rounded fragments of minerals or rocks between 3 and 10 inches in diameter.

Cobbly soil. A soil that is 20 to 30 percent coarse fragments, dominantly the size of cobblestones (from 3 to 10 inches in diameter).

Colluvium (colluvial deposits). Mixed deposits of rock fragments and coarse soil materials near the base of steep slopes. The deposits have accumulated as the result of soil creep, slides, or local wash.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Soft.—When dry, very weakly coherent and fragile; breaks into powder or individual grains under very slight pressure.

Slightly hard.—When dry, weakly resistant to pressure, easily broken between thumb and forefinger.

Hard.—When dry, moderately resistant to pressure; can barely be broken between thumb and forefinger.

Very hard.—When dry, very resistant to pressure; unbreakable between thumb and forefinger.

Friable.—When moist, crushes easily under moderate pressure between thumb and forefinger; can be pressed together into a lump.

Firm.—When moist, crushes under strong pressure; barely crushable between thumb and forefinger.

Nonsticky.—When wet, practically no soil material adheres to thumb or finger after pressure is released.

Slightly sticky.—When wet, soil material adheres to both thumb and finger after pressure is released, but comes off either thumb or finger rather cleanly. It does not appreciably stretch when the digits are separated.

Sticky.—When wet, soil material adheres to both thumb and finger after pressure is released; tends to stretch somewhat and pull apart rather than pillng free frotm either digit.

Very sticky.—When wet, soil material adheres strongly to both thumb and forefinger after pressure is released; decidedly stretched when digits are separated.

Nonplastic.—When wet, no wire forms.

Slightly plastic.—When wet, wire forms; slight pressure is required to deform the soil mass.

Plastic.—When wet, wire forms; moderate pressure is required to deform the soil mass.

Corrugation irrigation. See Irrigation.

Crop-residue management. Using plant residues to conserve moisture, reduce soil losses, improve soil tilth, and increase infiltration.

Diversion. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural).—The relative rapidity and extent of removal of water from, on, and within the soil under natural conditions. Terms commonly used to describe drainage are:

Very poorly drained.—Water is removed so slowly that the soil remains wet most of the time and water ponds on the surface frequently.

Poorly drained.—Water is removed so slowly that the soil is wet for significant periods.

Somewhat poorly drained.—Water is removed from the soil slowly enough that the soil is wet for significant periods but not all the time.

Moderately well drained.—Water is removed from the soil somewhat slowly so that the soil is wet for a short, but significant, time.

Well drained.—Water is removed from the soil readily.

Somewhat excessively drained.—Water is removed from the soil rapidly.

Excessively drained.—Water is removed from the soil very rapidly.

Eolian deposits. Wind-deposited materials moved fairly short distances and accumulated in dunes; generally coarse textured.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents. Relative terms are none, slight, moderate, high, and very high.

Fallow. Leaving cropland idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. The soil is tilled, but not seeded, for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding crop.

Flood plain. Nearly flat land adjacent to a stream that may be subject to overflow.

Furrow irrigation. See Irrigation.

Gilgai. Microrelief consisting of either a succession of enclosed microbasins and microknolls in nearly level areas, or of microvalleys and microridges that run normal to the slope (up and down slope). The microridges commonly range from a few inches to about 3 feet, seldom are they 6 feet.

Gravelly soil. A soil containing 20 to 50 percent gravel (coarse fragments between ¼ inch and 3 inches in diameter). A very gravelly soil is one that contains more than 50 percent gravel.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Igneous rock. A rock produced by the cooling of melted mineral material either below the surface (intrusive rocks) or at the surface (extrusive rocks) of the earth.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes or borders.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Krotovinas. Irregular tubular streaks within one horizon of material transported from another horizon. They are caused by the filling of tunnels made by burrowing animals in one horizon from outside the horizon.

Leaching. The removal of materials in solution by the passage of water through the soil.

Leveling (of land). The reshaping or modification of the land surface to a planned grade to provide a more suitable surface for the efficient application of irrigation water and to provide proper surface drainage.

Lime. Carbonates, calcium carbonate ($CaCO_3$), and calcium magnesium carbonate. Agricultural lime refers to these compounds. It is generally expressed as calcium carbonate equivalent.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *Fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Nonirrigated farming. Growing crops that require some tillage without irrigation. The system requires periods of fallow between crops. During periods of fallow, water is absorbed and retained.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, molybdenum, and perhaps others obtained from the soil and carbon, hydrogen, and oxygen obtained mainly from air and water.

Parent material. The unconsolidated material from which the soil profile develops.

Particle. An individual grain of soil, regardless of shape, within a definite size group, such as a clay, silt, or sand particle.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod, which is a mass of soil brought about by digging or other disturbance.

Permeability, soil. That quality of the soil that enables it to transmit water or air. Terms used to describe permeability are the following:

	Inches per hour
Very slow	Less than 0.06
Slow	0.06 to 0.2
Moderately slow	0.2 to 0.60
Moderate	0.60 to 2.0
Moderately rapid	2.0 to 6.0
Rapid	6.0 to 10.0
Very rapid	More than 10.0

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; a lower value, acidity.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Moderately alkaline	7.9 to 8.4
Very strongly acid	4.5 to 5.0	Strongly alkaline	8.5 to 9.0
Strongly acid	5.1 to 5.5	Very strongly alkaline	9.1 and higher
Medium acid	5.6 to 6.0		
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		
Mildly alkaline	7.4 to 7.8		

Reclamation of soils. In this survey area, the removal of excess water, salt, and alkali from the soils in order to make them suitable for crops.

Roots (abundance of). Following are terms used to describe abundance of roots: *Many,* more than 25 percent of the surface area is penetrated; *common,* 3 to 25 percent of the surface area is penetrated; and *few,* less than 3 percent of the surface area is penetrated.

Runoff, surface. The surface flow of water from an area or the total volume or surface flow during a specified time. Relative terms are very rapid, rapid, medium, slow, very slow, and ponded.

Saline soil. A soil that contains soluble salts in quantities that impair its productivity for plants but that does not contain an excess of exchangeable sodium. Following are terms for degrees of salinity:

Slightly saline (low).—The conductivity of the saturation extract of the soils is 4 to 8 millimhos within 30 inches of the surface.

Moderately saline.—The conductivity of the saturation extract of the soils is 8 to 16 millimhos within 30 inches of the surface.

Strongly saline (high).—The conductivity of the saturation extract is more than 16 millimhos within 30 inches of the surface.

Very strongly saline (very high).—More than 2 percent of the matrix is soluble salt.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium. The salts and exchangeable sodium are so distrubuted in the soil that growth of most crop plants is significantly reduced.

Sand. Soil particles that range in diameter from 0.05 millimeter to 2.0 millimeters. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope classes. The following slope classes are used in this survey:

Nearly level	0 to 1 percent
Gently sloping	1 to 3 percent
Moderately sloping	3 to 6 percent
Strongly sloping	6 to 10 percent
Moderately steep	10 to 16 percent
Steep	16 to 30 percent
Very steep	More than 30 percent

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

Solum. The upper part of the soil profile above the parent material; the part of the profile that has been noticeably affected by the soil-forming processes. The solum of mature soils consists of the A and B horizons.

Stones. Coarse fragments more than 10 inches in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular.* *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together

without any regular cleavage, as in many claypans and hardpans).

Subsoil. That part of the soil profile commonly below plow depth and above the parent material.

Substratum. The soil material below the surface soil and the subsoil; the C horizon.

Surface soil. The upper part of the soil that is commonly the horizon of maximum organic accumulation and has granular or platy structure and corresponds closely to the A horizon.

Terrace (geological). An old bench, orinarily flat or less sloping than the terrace escarpment adjacent to it. It resembles steps in a stairway.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. (See also Clay, Sand, and Silt.) The basic textural classes, in order of increasing proportions of fine particles, are as follows: *Sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Coarse-textured soil.—A soil that contains a large proportion of sand, that is loose and noncoherent when dry, and that is generally relatively low in fertility and in available moisture capacity; highly erodible. Coarse-textured soils are sands and loamy sands.

Moderately coarse textured soil.—A soil that has a high content of sand but contains enough silt and clay to form fragile aggregates; individual grains of sand are easily seen, and the soil mass feels gritty; highly erodible. Moderately coarse textured soils are sandy loams and fine sandy loams.

Medium-textured soil.—A soil that generally is friable and easily tilled. Medium-textured soils are very fine sandy loams, loams, silt loams, and silts.

Moderately fine textured soil.—A soil that has a texture intermediate between fine and medium. Moderately fine textured soils are clay loams, sandy clay loams, and silty clay loams.

Fine-textured soil.—A soil that contains a large proportion of clay; it is normally hard when dry and plastic when wet. Fine-textured soils are sandy clays, silty clays, and clays.

Topsoil. A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water-supplying capacity. The capacity of a soil to supply water that is stored during periods of plant dormancy plus the precipitation during the growing season until moisture is depleted.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the individual mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit or a range site, read the introduction to the section it is assigned for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, p. 8.
Estimated yields, table 2, p. 124.
Engineering, tables 4, 5, and 6, pp. 144 through 191.

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
ABE	Abela gravelly loam, 10 to 20 percent slopes	11	---------	----	VIs-U	118	Upland Stony Loam	131
AEE	Abela stony loam, 6 to 20 percent slopes	11	---------	----	VIIs-U	121	Upland Stony Loam	131
AGG	Agassiz-Picayune association, very steep	12						
	Agassiz soil	--	---------	----	VIIs-M	121	Mountain Shallow Loam	133
	Picayune soil	--	---------	----	VIIe-M	119	Mountain Loam	132
Ao	Airport silt loam	12	IVw-28	113	------------	----	Alkali Bottom	134
Ap	Airport silt loam, sandy substratum	13	IIIw-28	111	------------	----	Alkali Bottom	134
Ar	Airport silt loam, strongly alkali	13	---------	----	VIIw-28	120	Alkali Bottom	134
AtB	Anty fine sandy loam, 1 to 6 percent slopes	14	---------	----	IIIe-U	113	-------------------	----
AtD	Anty fine sandy loam, 6 to 10 percent slopes	14	---------	----	IIIe-U	113	-------------------	----
AV	Arave silty clay loam	15	---------	----	VIIw-28	120	Salt Meadow	135
BCG	Bickmore loam, 50 to 70 percent slopes	15	---------	----	VIIe-HC	120	-------------------	----
BdB	Bingham loam, 1 to 6 percent slopes	16	---------	----	IVs-U4	116	-------------------	----
BeB	Bingham gravelly loam, 1 to 6 percent slopes	16	---------	----	IVs-U4	116	-------------------	----
BeD	Bingham gravelly loam, 6 to 10 percent slopes	16	---------	----	IVs-U4	116	-------------------	----
BgE	Blue Star gravelly loam, 6 to 20 percent slopes	17	---------	----	VIs-U	118	Upland Stony Loam	131
BhD	Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes	18	---------	----	VIs-U	118	Upland Sand	132
BLG	Blue Star association, steep	17						
	Blue Star soil	--	---------	----	VIIs-U	121	Upland Stony Loam	131
	Blue Star gravelly subsoil variant	--	---------	----	VIs-U	118	Upland Sand	132
Bp	Borrow pits	18	---------	----	VIIIs-4	122	-------------------	----
BR	Bram silt loam	19	IIIw-28	111	VIIs-S8	121	Semidesert Alkali Flats	128
BSE	Broad cobbly loam, 20 to 30 percent slopes	20	---------	----	VIs-M	119	Mountain Stony Loam	133
BSG	Broad cobbly loam, 30 to 60 percent slopes	20	---------	----	VIIs-M	121	Mountain Stony Loam	133
BTG	Broad-Manila association, steep	20						
	Broad soil	--	---------	----	VIIs-M	121	Mountain Stony Loam	133
	Manila soil	--	---------	----	VIIe-M	119	Mountain Loam	132
BUG	Broad-Middle association, steep	20						
	Broad soil	--	---------	----	VIIs-M	121	Mountain Stony Loam	133
	Middle soil	--	---------	----	VIIe-U	119	Upland Loam	130
BVG	Broad-Smarts association, steep	20						
	Broad soil	--	---------	----	VIIs-M	121	Mountain Stony Loam	133
	Smarts soil	--	---------	----	VIIe-M	119	Mountain Loam (Shrub)	133
Co	Collett silty clay loam	21	IIIw-25	111	------------	----	Wet Meadow	135
CwD	Collinston-Wheelon silt loams, 6 to 10 percent slopes	22	---------	----	VIe-U	118	Upland Shallow Loam	130

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
Cy	Cudahy silt loam	22	IVw-28	113	------------	----	Wet Meadow	135
DaB	Dagor loam, 3 to 6 percent slopes	23	IIe-1	109	------------	----	------------------	----
DgB	DeJarnet gravelly silt loam, 1 to 6 percent slopes	24	---------	----	IVs-U4	116	------------------	----
DgD	DeJarnet gravelly silt loam, 6 to 10 percent slopes	24	---------	----	IVs-U4	116	------------------	----
DrA	Draper loam, 0 to 3 percent slopes	25	IIw-2	109	------------	----	------------------	----
DU	Drum silt loam	26	---------	----	VIIs-D8	120	Desert Flats	128
EcA	Eccles fine sandy loam, 0 to 1 percent slopes	27	---------	----	IVc-U	116	------------------	----
EcB	Eccles fine sandy loam, 1 to 6 percent slopes	27	---------	----	IVe-UZ	115	------------------	----
EcD	Eccles fine sandy loam, 6 to 10 percent slopes	28	---------	----	IVe-UZ	115	------------------	----
ElB	Eccles loamy sand, sandy variant, 1 to 6 percent slopes	28	---------	----	IVs-UZ	116	------------------	----
EMF	Elzinga-Agassiz association, steep	29						
	Elzinga soil	--	---------	----	VIIe-M	119	Mountain Loam (Shrub)	133
	Agassiz soil	--	---------	----	VIIs-M	121	Mountain Shallow Loam	133
ENF	Elzinga-Maughan complex, 25 to 50 percent slopes	29	---------	----	VIIe-M	119	Mountain Loam (Shrub)	133
ETB	Etil loamy sand, 1 to 6 percent slopes	30	---------	----	VIIs-S	121	Semidesert Sand	129
Fd	Fielding silt loam	31	IIc-2	110	------------	----	------------------	----
Fe	Fielding silt loam, warm	31	I-1	108	------------	----	------------------	----
FgB	Forsgren silt loam, 1 to 6 percent slopes	32	---------	----	IIIe-U	113	------------------	----
FgD	Forsgren silt loam, 6 to 10 percent slopes	32	---------	----	IIIe-U	113	------------------	----
FgE	Forsgren silt loam, 10 to 20 percent slopes	32	---------	----	IVe-U	115	Upland Loam	130
FHG	Foxol-Elzinga association, steep	32						
	Foxol soil	--	---------	----	VIIs-M	121	Mountain Shallow Loam	133
	Elzinga soil	--	---------	----	VIIe-M	119	Mountain Loam (Shrub)	133
FRG	Foxol-Rock outcrop complex, 50 to 70 percent slopes	32	---------	----	VIIs-M	121	Mountain Shallow Loam	133
FsB	Francis loamy fine sand, 3 to 6 percent slopes	33	IIIe-16	110	------------	----	------------------	----
FT	Fresh water marsh	33	---------	----	VIIIw-2	122	------------------	----
Fu	Fridlo silt loam	34	IVw-28	113	------------	----	Alkali Bottom	134
Fv	Fridlo silt loam, moderately alkali	34	IIIw-28	111	------------	----	Alkali Bottom	134
GcD	Gemson silty clay loam, 6 to 10 percent slopes	36	---------	----	IIIe-U	113	Upland Loam	130
GcE	Gemson silty clay loam, 10 to 20 percent slopes	36	---------	----	IVe-U	115	Upland Loam	130
GEE	Gemson-Rock land association, moderately steep	36						
	Gemson soil	--	---------	----	IVe-U	115	Upland Loam	130
	Middle soil	--	---------	----	VIe-U	118	Upland Loam	130
	Rock land	--	---------	----	VIIIs-X	122	------------------	----
Gh	Gooch silt loam	37	---------	----	VIIw-28	120	Salt Meadow	135

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
GLE	Goring-Yeates Hollow association, moderately steep-----------------	37						
	Goring soil--------------------	--	---------	----	VIe-M	118	Mountain Loam	132
	Yeates Hollow soil-------------	--	---------	----	VIs-M	119	Mountain Stony Loam	133
GM	Goring loam, brown subsoil variant-	38	---------	----	VIe-M	118	Mountain Loam	132
Gp	Gravel pits------------------------	38	---------	----	VIIIs-4	122	------------------	----
Gr	Greenson silt loam, clay substratum-------------------------	39	IIIw-25	111	------------	----	------------------	----
Gs	Greenson silt loam, strongly alkali--------------------------	39	IVw-28	113	------------	----	Alkali Bottom	134
GU	Gullied land-----------------------	40	---------	----	VIIIe-E	122	------------------	----
HaA	Hansel silt loam, 0 to 1 percent slopes--------------------------	41	IIc-2	110	IVc-U	116	------------------	----
HaB	Hansel silt loam, 1 to 6 percent slopes--------------------------	41	---------	----	IVe-UZ	115	------------------	----
HaD	Hansel silt loam, 6 to 10 percent slopes--------------------------	41	---------	----	IVe-UZ	115	------------------	----
HD	Hardin silt loam-------------------	42	---------	----	VIIs-S8	121	Semidesert Alkali Flats	128
HeB	Hendricks silt loam, 1 to 6 percent slopes--------------------------	42	---------	----	IIe-M	113	------------------	----
HeD	Hendricks silt loam, 6 to 10 percent slopes------------------	43	---------	----	IIIe-M	114	------------------	----
HeE	Hendricks silt loam, 10 to 20 percent slopes------------------	43	---------	----	IVe-M	115	------------------	----
HkD	Hendricks complex, 6 to 10 percent slopes--------------------------	43	---------	----	IIIe-M	114	------------------	----
Ho	Honeyville silty clay loam---------	44	IIIw-25	111	------------	----	------------------	----
HpB	Hupp gravelly silt loam, 1 to 6 percent slopes------------------	45	---------	----	IVs-UZ	116	Upland Stony Loam	131
HpD	Hupp gravelly silt loam, 6 to 10 percent slopes------------------	45	---------	----	IVs-UZ	116	Upland Stony Loam	131
HuC	Hupp silt loam, 3 to 6 percent slopes--------------------------	45	---------	----	IVs-UZ	116	------------------	----
HuD	Hupp silt loam, 6 to 10 percent slopes--------------------------	45	---------	----	IVs-UZ	116	------------------	----
JaA	James Canyon loam, 0 to 3 percent slopes--------------------------	46	IIw-2	109	------------	----	Semiwet Meadow	135
KaE	Kapod stony loam, 6 to 20 percent slopes--------------------------	47	---------	----	VIIs-U	121	Upland Stony Loam	131
KeB	Kearns silt loam, 1 to 3 percent slopes--------------------------	49	IIc-2	110	IIIe-U	113	------------------	----
KeC	Kearns silt loam, 3 to 6 percent slopes--------------------------	49	IIe-2	109	IIIe-U	113	------------------	----
KeD	Kearns silt loam, 6 to 10 percent slopes--------------------------	49	---------	----	IIIe-U	113	------------------	----
KeE	Kearns silt loam, 10 to 20 percent slopes--------------------------	49	---------	----	IVe-U	115	------------------	----
KgD	Kearns-Stingal complex, 6 to 10 percent slopes------------------	49	---------	----	IVe-UZ	115	------------------	----
KhE	Kearns silt loam, high lime variant, 10 to 20 percent slopes----------	50	---------	----	IVe-U	115	------------------	----
KlA	Kidman fine sandy loam, 0 to 2 percent slopes------------------	51	I-1	108	------------	----	------------------	----
KlB	Kidman fine sandy loam, 2 to 4 percent slopes------------------	51	IIe-1	109	------------	----	------------------	----
KmA	Kidman loam, 0 to 1 percent slopes-	51	---------	----	IIIc-U	115	------------------	----
KmB	Kidman loam, 1 to 6 percent slopes-	51	---------	----	IIIe-U	113	------------------	----
KmD	Kidman loam, 6 to 10 percent slopes--------------------------	51	---------	----	IIIe-U	113	------------------	----

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
KmE	Kidman loam, 10 to 20 percent slopes	51	---------	----	IVe-U	115	Upland Loam	130
KnC	Kilburn gravelly sandy loam, 3 to 6 percent slopes	52	IIIe-16	110	------------	----	-------------------	----
KnD	Kilburn gravelly sandy loam, 6 to 10 percent slopes	52	IVe-16	112	------------	----	-------------------	----
KnE	Kilburn gravelly sandy loam, 10 to 20 percent slopes	52	IVe-16	112	VIs-U	118	Upland Stony Loam	131
KnF	Kilburn gravelly sandy loam, 20 to 30 percent slopes	52	---------	----	VIs-U	118	Upland Stony Loam	131
KnG	Kilburn gravelly sandy loam, 30 to 60 percent slopes	52	---------	----	VIIs-U	121	Upland Stony Loam	131
KoB	Kilburn gravelly loam, 1 to 3 percent slopes	52	IIIs-16	112	------------	----	-------------------	----
Kr	Kirkham silt loam	53	IVw-28	113	------------	----	Alkali Bottom	134
LA	Lakeshore fine sandy loam	54	---------	----	VIIw-28	120	Salt Meadow	135
Lc	Lasil silt loam	55	---------	----	VIIw-28	120	Alkali Bottom	134
Ld	Lasil silt loam, moderately alkali	55	IVw-28	113	------------	----	Alkali Bottom	134
Lr	Lasil-Airport silt loams	55	---------	----	VIIw-28	120	Alkali Bottom	134
Ls	Lewiston fine sandy loam	56	IIw-2	109	------------	----	-------------------	----
Lt	Logan silty clay loam	57	IIIw-25	111	------------	----	Wet Meadow	135
LUE	Lucky Star-Elzinga association, steep	58						
	Lucky Star soil	--	---------	----	VIe-H	118	High Mountain Loam (Aspen)	134
	Elzinga soil	--	---------	----	VIIe-M	119	Mountain Loam (Shrub)	133
Ma	Magna silty clay loam	58	IVw-28	113	------------	----	Alkali Bottom	134
MbC	Manila loam, 6 to 10 percent slopes	59	---------	----	IIIe-M	114	-------------------	----
MbE	Manila loam, 10 to 25 percent slopes	59	---------	----	IVe-M	115	Mountain Loam	132
MCG	Manila loam, 25 to 60 percent slopes	60	---------	----	VIIe-M	119	Mountain Loam	132
MDG	Manila-Smarts association, steep	60						
	Manila soil	--	---------	----	VIIe-M	119	Mountain Loam	132
	Smarts soil	--	---------	----	VIIe-M	119	Mountain Loam (Shrub)	133
Me	Martini fine sandy loam	60	IIw-2	109	------------	----	Semiwet Meadow	135
MFB	Mellow silt loam, 1 to 6 percent slopes	62	---------	----	VIIs-S8	121	Semidesert Alkali Flats	128
MGB	Mellow-Thiokol silt loams, 1 to 6 percent slopes	62	---------	----	VIIs-S8	121	Semidesert Alkali Flats	128
MhB	Mendon silt loam, 1 to 6 percent slopes	63	---------	----	IIe-M	113	-------------------	----
MhD	Mendon silt loam, 6 to 10 percent slopes	63	---------	----	IIIe-M	114	-------------------	----
MIE	Middle cobbly silt loam, 10 to 30 percent slopes	64	---------	----	VIe-U	118	Upland Loam	130
MIG	Middle cobbly silt loam, 30 to 70 percent slopes	64	---------	----	VIIe-U	119	Upland Loam	130
MJG	Middle-Broad association, steep	64						
	Middle soil	--	---------	----	VIIe-U	119	Upland Loam	130
	Broad soil	--	---------	----	VIIs-M	121	Mountain Stony Loam	133
MKE	Middle-Rock outcrop complex, 10 to 30 percent slopes	64	---------	----	VIe-U	118	Upland Loam	130

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
MKG	Middle-Rock outcrop complex, 30 to 60 percent slopes	65	---------	----	VIIe-U	119	Upland Loam	130
M1A	Millville silt loam, 0 to 2 percent slopes	66	I-1	108	------------	----	------------------	----
M1B	Millville silt loam, 2 to 4 percent slopes	66	IIe-1	109	------------	----	------------------	----
MmB	Millville silt loam, moderately deep water table, 2 to 4 percent slopes	66	IIw-2	109	------------	----	------------------	----
MuE	Munk gravelly silt loam, 10 to 20 percent slopes	67	---------	----	VIs-U	118	Upland Stony Loam	131
OBE	Obray clay, 10 to 25 percent slopes	68	---------	----	VIe-M	118	Mountain Clay	132
PAB	Palisade silt loam, 1 to 6 percent slopes	69	IIIe-3	110	VIIe-S	119	Semidesert Loam	128
PAD	Palisade silt loam, 6 to 10 percent slopes	69	---------	----	VIIe-S	119	Semidesert Loam	128
PbA	Parleys loam, 0 to 3 percent slopes	70	I-1	108	------------	----	------------------	----
PdA	Parleys loam, cool, 0 to 3 percent slopes	70	IIc-2	110	------------	----	------------------	----
PeA	Parleys silt loam, 0 to 1 percent slopes	70	---------	----	IIIc-U	115	------------------	----
PeB	Parleys silt loam, 1 to 6 percent slopes	70	---------	----	IIIe-U	113	------------------	----
PeD	Parleys silt loam, 6 to 10 percent slopes	70	---------	----	IIIe-U	113	Upland Loam	130
PeE	Parleys silt loam, 10 to 20 percent slopes	70	---------	----	IVe-U	115	Upland Loam	130
PlA	Parleys silty clay loam, 0 to 3 percent slopes	70	I-1	108	------------	----	------------------	----
PmD	Parleys-Munk complex, 6 to 10 percent slopes	70	---------	----	IIIe-U	113	------------------	----
PmE	Parleys-Munk complex, 10 to 20 percent slopes	71	---------	----	IVe-U	115	Upland Loam	130
PnD	Parleys-Pomat silt loams, 6 to 10 percent slopes	71	---------	----	IIIe-U	113	------------------	----
POE	Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes	71	---------	----	VIIs-U	121	Upland Shallow Loam	130
Pr	Payson silt loam	72	---------	----	VIIw-28	120	Alkali Bottom	134
Ps	Peteetneet peat, moderately deep variant	73	---------	----	VIIw-2	120	Wet Meadow	135
PT	Placeritos silt loam	74	---------	----	VIIw-28	120	Alkali Bottom	134
PU	Playas	74	---------	----	VIIIw-8	122	------------------	----
PVC	Pogal silt loam, rolling	75	---------	----	VIIs-S8	121	Semidesert Alkali Flats	128
PwD	Pomat silt loam, 6 to 10 percent slopes	76	---------	----	IVe-UZ	115	------------------	----
PwE	Pomat silt loam, 10 to 30 percent slopes	76	---------	----	VIe-U	118	Upland Loam	130
PwG2	Pomat silt loam, 30 to 40 percent slopes, eroded	76	---------	----	VIIe-U	119	Upland Loam	130
PxE	Pomat-Kearns silt loams, 10 to 30 percent slopes	76	---------	----	VIe-U	118	Upland Loam	130
PyE	Pomat-Parleys silt loams, 10 to 30 percent slopes	77	---------	----	VIe-U	118	Upland Loam	130
RdA	Red Rock silt loam, high rainfall, 0 to 3 percent slopes	78	---------	----	IIe-M	113	------------------	----
ReA	Red Rock silt loam, 0 to 1 percent slopes	78	IIc-2	110	IIIc-U	115	------------------	----

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
ReB	Red Rock silt loam, 1 to 6 percent slopes	78	---------	----	IIIe-U	113	------------------	----
Rf	Refuge loam	79	---------	----	VIIw-28	120	Alkali Bottom	134
RMG2	Richmond-Middle complex, 30 to 70 percent slopes, eroded	80	---------	----	VIIs-U	121	Upland Shallow Loam	130
RrE	Ridd-Rock outcrop complex, 10 to 30 percent slopes	80	---------	----	VIIs-U	121	Upland Stony Loam	131
RrG	Ridd-Rock outcrop complex, 30 to 70 percent slopes	80	---------	----	VIIs-U	121	Upland Stony Loam	131
RS	Rock land	81	---------	----	VIIIs-X	122	------------------	----
RT	Rock outcrop	81	---------	----	VIIIs-X	122	------------------	----
Ru	Roshe Springs silt loam	81	IIIw-2	110	------------	----	Wet Meadow	135
Rv	Rough broken land	81	---------	----	VIIe-U	119	Upland Loam	130
RWG	Rozlee-Rock outcrop complex, 30 to 70 percent slopes	82	---------	----	VIIs-U	121	Upland Stony Hills (Juniper)	131
SA	Saltair silty clay loam	83	---------	----	VIIIw-8	122	------------------	----
SB	Saltair-Fresh water marsh association	83						
	Saltair soil	--	---------	----	VIIIw-8	122	------------------	----
	Fresh water marsh	--	---------	----	VIIIw-2	122	------------------	----
SC	Saltair-Logan association	83						
	Saltair soil	--	---------	----	VIIIw-8	122	------------------	----
	Logan soil	--	---------	----	VIIw-28	120	Salt Meadow	135
Sd	Saltair-Refuge complex	83	---------	----	VIIw-28	120	Alkali Bottom	134
SEE	Sandall cobbly silt loam, 10 to 30 percent slopes	84	---------	----	VIs-U	118	Upland Stony Hills (Juniper)	131
SEG	Sandall cobbly silt loam, 30 to 60 percent slopes	84	---------	----	VIIs-U	121	Upland Stony Hills (Juniper)	131
SFG	Sandall-Broad association, steep	84						
	Sandall soil	--	---------	----	VIIs-U	121	Upland Stony Hills (Juniper)	131
	Broad soil	--	---------	----	VIIs-M	121	Mountain Stony Loam	133
SGG	Sandall-Promo association, steep	85	---------	----	VIIs-U	121	Upland Stony Hills (Juniper)	131
SHE	Sandall-Rock outcrop complex, 3 to 30 percent slopes	85	---------	----	VIIs-U	121	Upland Stony Loam	131
SJG	Sandall-Rozlee association, steep	85	---------	----	VIIs-U	121	Upland Stony Hills (Juniper)	131
SkE	Sanpete gravelly silt loam, 6 to 30 percent slopes	86	---------	----	VIIs-S	121	Semidesert Stony Loam	129
S1B	Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes	86	---------	----	IVs-UZ	116	Upland Stony Loam	131
S1D	Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes	86	---------	----	IVs-UZ	116	Upland Stony Loam	131
S1E	Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes	86	---------	----	VIs-U	118	Upland Stony Loam	131
S1G	Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes	86	---------	----	VIIs-U	121	Upland Stony Loam	131
SMB	Saxby-Thiokol complex, 1 to 6 percent slopes	87	---------	----	VIIs-S	121	Semidesert Shallow Loam	129

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
SN	Saxby-Very stony land association--	87	---------	----	VIIs-S	121	Semidesert Shallow Loam	129
SoD	Sheeprock gravelly sandy loam, 6 to 10 percent slopes-------------	88	---------	----	VIs-U	118	Upland Sand	132
SpF3	Sheeprock gravelly loam, 10 to 40 percent slopes, severely eroded--	88	---------	----	VIIs-U	121	Upland Sand	132
SQG	Smarts loam, 30 to 70 percent slopes---------------------------	89	---------	----	VIIe-M	119	Mountain Loam (Shrub)	133
SrE	Snowville gravelly silt loam, 6 to 20 percent slopes----------------	89	---------	----	VIIs-U	121	Upland Shallow Loam	130
SsB	Sterling gravelly loam, 1 to 6 percent slopes-------------------	90	---------	----	IVs-U4	116	-------------------	----
SsD	Sterling gravelly loam, 6 to 20 percent slopes-------------------	90	---------	----	IVs-U4	116	Upland Stony Loam	131
SsF	Sterling gravelly loam, 20 to 30 percent slopes-------------------	90	---------	----	VIs-U	118	Upland Stony Loam	131
SsG	Sterling gravelly loam, 30 to 50 percent slopes-------------------	91	---------	----	VIIs-U	121	Upland Stony Loam	131
StE	Sterling very stony loam, 10 to 30 percent slopes-------------------	91	---------	----	VIIs-U	121	Upland Stony Loam	131
SuE	Sterling-Parleys complex, 6 to 20 percent slopes-------------------	91	---------	----	IVs-UZ	116	Upland Stony Loam	131
SvB	Stingal loam, 1 to 6 percent slopes--------------------------	92	---------	----	IVe-UZ	115	Upland Loam	130
SvD	Stingal loam, 6 to 10 percent slopes--------------------------	92	---------	----	IVe-UZ	115	------------------	----
Sw	Stokes silt loam-------------------	93	IVw-28	113	------------	----	Alkali Bottom	134
Sx	Stony alluvial land----------------	93	---------	----	VIIs-U	121	Upland Stony Loam	131
Sy	Sunset silt loam-------------------	94	IIw-2	109	------------	----	------------------	----
Sz	Syracuse fine sandy loam-----------	95	IIIw-2	110	------------	----	Alkali Bottom	134
ThA	Thiokol silt loam, 0 to 1 percent slopes--------------------------	96	---------	----	IVc-U	116	------------------	----
ThB	Thiokol silt loam, 1 to 6 percent slopes--------------------------	97	---------	----	IVe-UZ	115	------------------	----
ThD	Thiokol silt loam, 6 to 10 percent slopes--------------------------	97	---------	----	IVe-UZ	115	------------------	----
TkA	Thiokol silt loam, low rainfall, 0 to 1 percent slopes-----------	97	IIIc-3	112	VIIc-S	122	Semidesert Loam	128
TkB	Thiokol silt loam, low rainfall, 1 to 3 percent slopes-----------	97	IIIe-3	110	VIIe-S	119	Semidesert Loam	128
TmA	Timpanogos loam, 0 to 3 percent slopes--------------------------	98	I-1	108	------------	----	------------------	----
TmB	Timpanogos loam, 3 to 6 percent slopes--------------------------	98	IIe-1	109	------------	----	------------------	----
TnA	Timpanogos loam, cool, 0 to 3 percent slopes------------------	98	IIc-2	110	------------	----	------------------	----
ToB	Timpanogos silt loam, 1 to 6 percent slopes-------------------	98	---------	----	IIIe-U	113	------------------	----
ToC	Timpanogos silt loam, 6 to 10 percent slopes------------------	98	---------	----	IIIe-U	113	------------------	----
UF	Uffens silt loam-------------------	99	---------	----	VIIs-D8	120	Desert Flats	128
VS	Very stony land--------------------	99	---------	----	VIIs-S	121	Semidesert Shallow Loam	129
Wa	Warm Springs fine sandy loam-------	100	IIw-2	109	------------	----	Alkali Bottom	134
WcC	Wasatch gravelly sandy loam, 3 to 10 percent slopes----------------	100	IVs-16	112	------------	----	------------------	----
WcE	Wasatch gravelly sandy loam, 10 to 25 percent slopes----------------	101	---------	----	VIs-U	118	Upland Sand	132

Map symbol	Mapping unit	Page	Capability unit: Irrigated	Page	Capability unit: Nonirrigated	Page	Range site: Name	Page
WdG	Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes-------------	101	---------	----	VIIs-U	121	Upland Sand	132
WeE	Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes--------------------------	101	---------	----	VIIs-U	121	Upland Sand	132
WhG	Wheelon silt loam, 30 to 60 percent slopes-------------------	102	---------	----	VIIe-U	119	Upland Shallow Loam	130
W1G	Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes-	103	---------	----	VIIs-U	121	Upland Shallow Loam	130
WmE	Wheelon-Collinston silt loams, 10 to 30 percent slopes-------------	102	---------	----	VIe-U	118	Upland Shallow Loam	130
WnB	Windmill gravelly loam, 1 to 6 percent slopes-------------------	103	---------	----	IVe-UZ	115	Upland Loam	130
WnD	Windmill gravelly loam, 6 to 10 percent slopes-------------------	104	---------	----	IVe-UZ	115	Upland Loam	130
WnE	Windmill gravelly loam, 10 to 20 percent slopes-------------------	104	---------	----	VIe-U	118	Upland Loam	130
Wo	Woods Cross silty clay loam--------	104	IIIw-25	111	------------	----	Wet Meadow	135
Wr	Woods Cross silty clay loam, moderately saline-------------------	105	---------	----	VIIw-28	120	Salt Meadow	135
YHE	Yeates Hollow cobbly clay loam, 20 to 30 percent slopes-------------	105	---------	----	VIs-M	119	Mountain Stony Loam	133
YHG	Yeates Hollow cobbly clay loam, 30 to 60 percent slopes------------	105	---------	----	VIIs-M	121	Mountain Stony Loam	133
YRE	Yeates Hollow-Goring association, steep---------------------------	106	---------	----				
	Yeates Hollow soil------------	----	---------	----	VIs-M	119	Mountain Stony Loam	133
	Goring soil-------------------	----	---------	----	VIe-M	118	Mountain Loam	132

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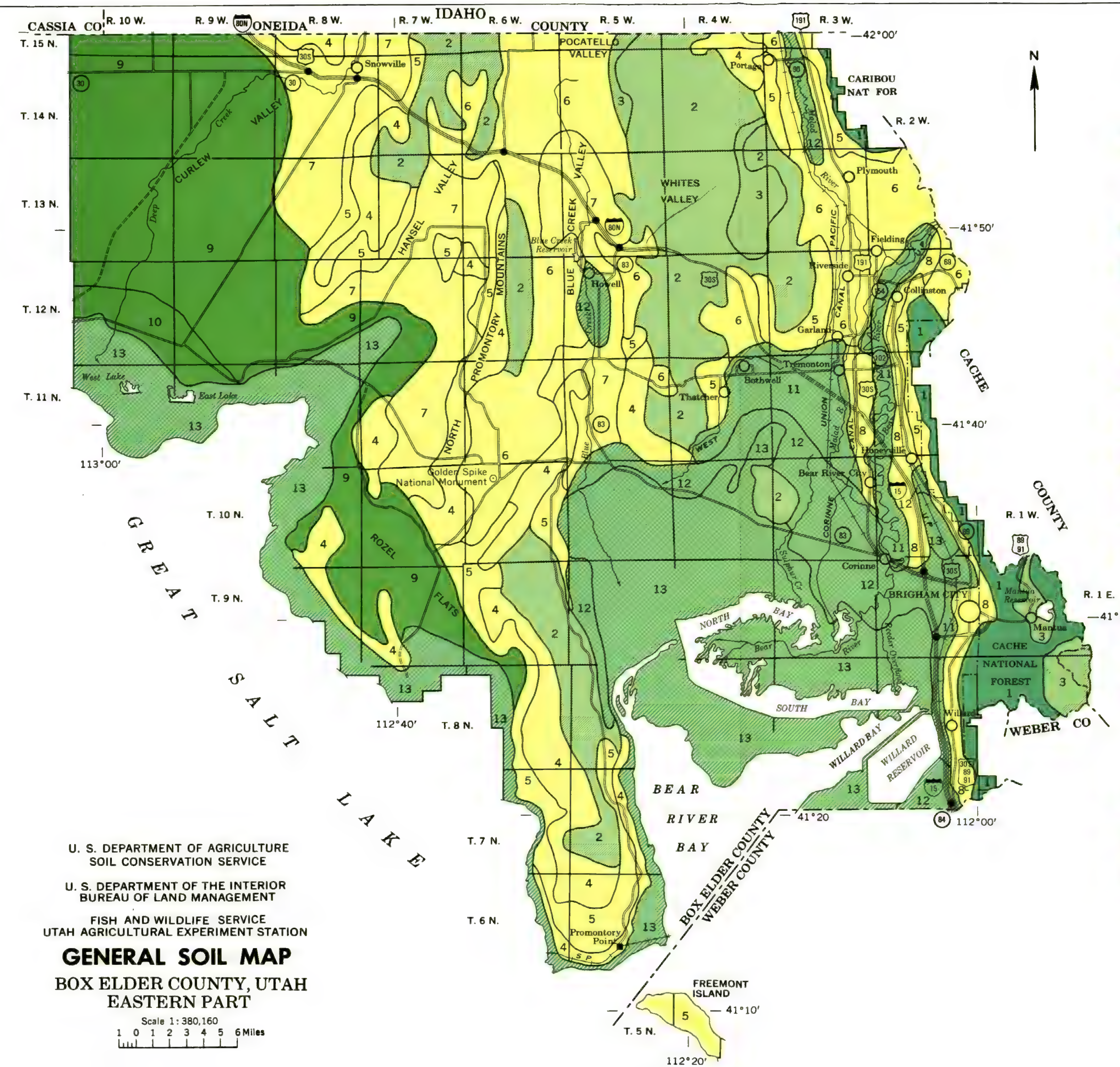


SOIL ASSOCIATIONS *

WELL-DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SOILS OF THE MOUNTAINS

1 — Foxol-Elzinga-Agassiz association: Well-drained and somewhat excessively drained, very steep silt loams, gravelly loams, and very stony loams; on mountains and alluvial fans

WELL-DRAINED SOILS OF THE MOUNTAIN FOOT SLOPES, HIGH FANS, AND TERRACES

2 — Middle-Broad association: Well-drained, gently sloping to very steep cobbly silt loams and cobbly loams; on mountain foot slopes

3 — Hendricks-Forsgren-Manila association: Well-drained, gently sloping to very steep silt loams and loams; on foothills, alluvial fans, and high lake terraces

MODERATELY WELL DRAINED TO SOMEWHAT EXCESSIVELY DRAINED SOILS OF THE HIGH, MEDIUM, AND LOW LAKE TERRACES AND FANS

4 — Sandall-Rozlee-Promo association: Somewhat excessively drained and well-drained, moderately sloping to very steep cobbly silt loams; on terraces and mountain foot slopes

5 — Hupp-Sterling-Abela association: Well-drained and somewhat excessively drained, gently sloping to very steep gravelly silt loams and gravelly loams; on alluvial fans, lake terraces, escarpments, and mountain foot slopes

6 — Kearns-Parleys association: Well drained and moderately well drained, nearly level to steep silt loams; on alluvial fans and lake terraces

7 — Sanpete-Stingal-Hansel association: Somewhat excessively drained and well-drained, gently sloping to steep gravelly silt loams and silt loams; on lake terraces and escarpments

8 — Fielding-Kilburn-Kidman association: Well-drained and somewhat excessively drained, nearly level to very steep silt loams, gravelly sandy loams, and fine sandy loams; on lake terraces, benches, alluvial fans, and broad valley plains

MODERATELY WELL DRAINED AND WELL DRAINED SOILS OF THE MEDIUM AND LOW LAKE TERRACES AND LAKE PLAINS

9 — Bram-Thiokol-Palisade association: Moderately well drained and well drained, nearly level to strongly sloping silt loams; on medium and low lake terraces and lake plains

10 — Drum-Uffens association: Moderately well drained and well drained, nearly level to moderately sloping silt loams; on low lake terraces and lake plains

MODERATELY WELL DRAINED TO POORLY DRAINED SOILS OF THE LOW LAKE TERRACES AND LAKE PLAINS

11 — Honeyville-Greenson-Collett association: Moderately well drained and somewhat poorly drained, nearly level silty clay loams and silt loams; on broad low lake terraces and lake plains

12 — Lasil-Fridlo association: Somewhat poorly drained and moderately well drained, nearly level and gently sloping silt loams; on broad low lake terraces and lake plains

13 — Playas-Saltair association: Playas and poorly drained, nearly level silty clay loams; on lake beds and broad plains

* Texture refers to the surface layer of the major soils in each soil association.

Compiled 1971

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

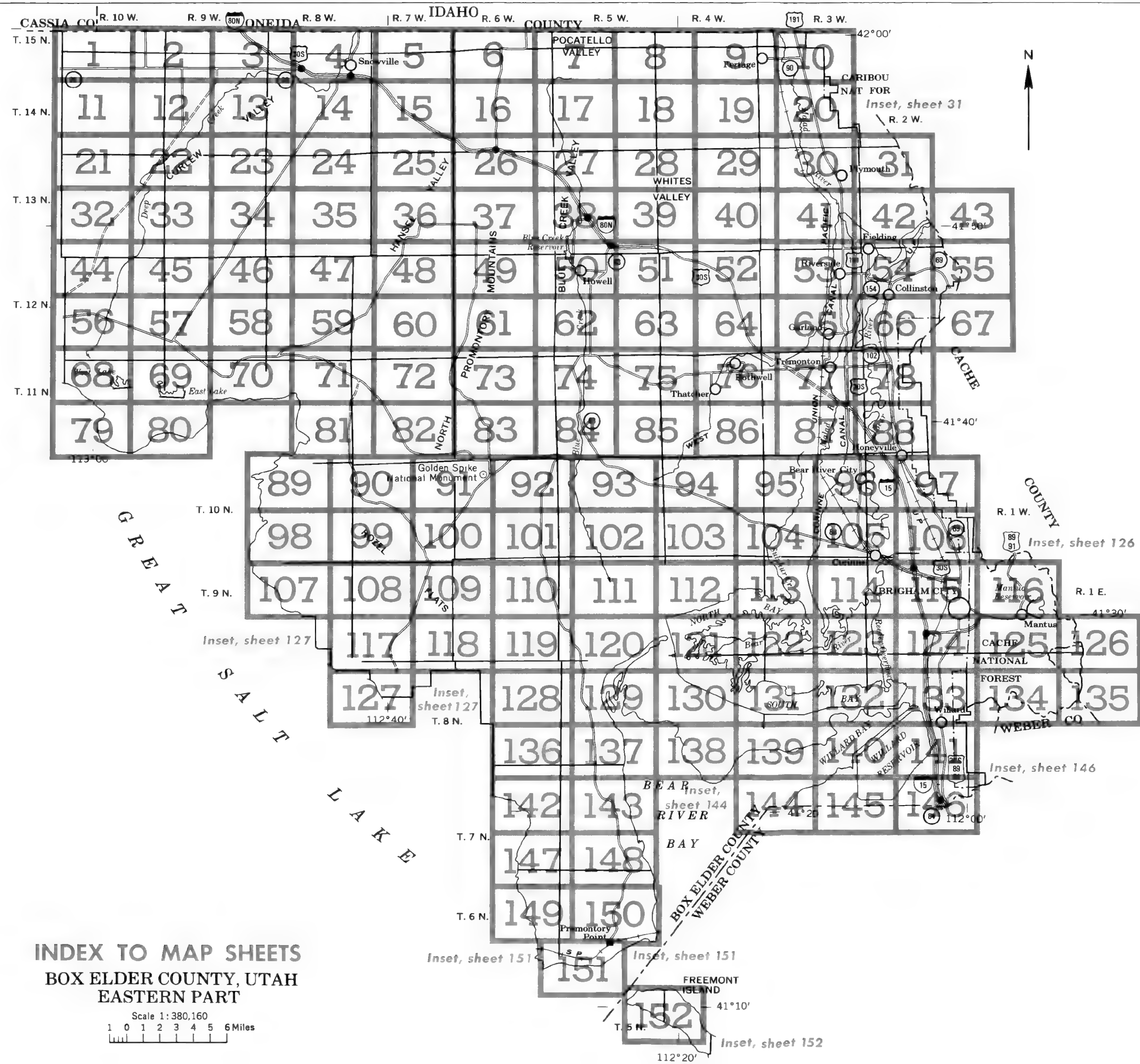
FISH AND WILDLIFE SERVICE
UTAH AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

BOX ELDER COUNTY, UTAH
EASTERN PART

Scale 1: 380,160
1 0 1 2 3 4 5 6 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
BOX ELDER COUNTY, UTAH
EASTERN PART

SOIL LEGEND

The first letter, always a capital, is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the low intensity survey *; otherwise it is a small letter. The third letter, always a capital A, B, C, D, E, F, or G, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. The final number, 2 or 3, in a symbol shows that the soil is eroded or severely eroded.

SYMBOL High Intensity	SYMBOL Low Intensity	NAME
-	ABE	Abela gravelly loam, 10 to 20 percent slopes
-	AEE	Abela stony loam, 6 to 20 percent slopes
	AGG	Agassiz-Picayune association, very steep
Ao	-	Airport silt loam
Ap	-	Airport silt loam, sandy substratum
Ar	-	Airport silt loam, strongly alkali
AtB	-	Anty fine sandy loam, 1 to 6 percent slopes
AtD	-	Anty fine sandy loam, 6 to 10 percent slopes
-	AV	Arave silty clay loam
	BCG	Bickmore loam, 50 to 70 percent slopes
BdB	-	Bingham loam, 1 to 6 percent slopes
BeB	-	Bingham gravelly loam, 1 to 6 percent slopes
BeD	-	Bingham gravelly loam, 6 to 10 percent slopes
BgE	-	Blue Star gravelly loam, 6 to 20 percent slopes
BhD	-	Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes
	BLG	Blue Star association, steep
Bp	-	Borrow pits
	BR	Bram silt loam
-	BSE	Broad cobbly loam, 20 to 30 percent slopes
-	BSG	Broad cobbly loam, 30 to 60 percent slopes
-	BTG	Broad-Manila association, steep
	BUG	Broad-Middle association, steep
-	BVG	Broad-Smarts association, steep
Co	-	Collett silty clay loam
CwD		Collinston-Wheelon silt loams, 6 to 10 percent slopes
Cy		Cudahy silt loam
DaB	-	Dagor loam, 3 to 6 percent slopes
DgB	-	DeJarnet gravelly silt loam, 1 to 6 percent slopes
DgD		DeJarnet gravelly silt loam, 6 to 10 percent slopes
DrA		Draper loam, 0 to 3 percent slopes
-	DU	Drum silt loam
EcA		Eccles fine sandy loam, 0 to 1 percent slopes
EcB	-	Eccles fine sandy loam, 1 to 6 percent slopes
EcD	-	Eccles fine sandy loam, 6 to 10 percent slopes
ElB	-	Eccles loamy sand, sandy variant, 1 to 6 percent slopes
-	EMF	Elzinga-Agassiz association, steep
-	ENF	Elzinga-Maughan complex, 25 to 50 percent slopes
-	ETB	Etil loamy sand, 1 to 6 percent slopes
Fd		Fielding silt loam
Fe	-	Fielding silt loam, warm
FgB	-	Forsgren silt loam, 1 to 6 percent slopes
FgD	-	Forsgren silt loam, 6 to 10 percent slopes
FgE		Forsgren silt loam, 10 to 20 percent slopes
-	FHG	Foxol-Elzinga association, steep
-	FRG	Foxol-Rock outcrop complex, 50 to 70 percent slopes
FsB		Francis loamy fine sand, 3 to 6 percent slopes
-	FT	Fresh water marsh
Fu	-	Fridlo silt loam
Fv	-	Fridlo silt loam, moderately alkali
GcD	-	Gemson silty clay loam, 6 to 10 percent slopes
GcE	-	Gemson silty clay loam, 10 to 20 percent slopes
	GEE	Gemson-Rock land association, moderately steep
Gh		Gooch silt loam
-	GLE	Goring-Yeates Hollow association, moderately steep
-	GM	Goring loam, brown subsoil variant
Gp	-	Gravel pits
Gr	-	Greenson silt loam, clay substratum
Gs	-	Greenson silt loam, strongly alkali
-	GU	Gullied land
HaA		Hansel silt loam, 0 to 1 percent slopes
HaB	-	Hansel silt loam, 1 to 6 percent slopes
HaD	-	Hansel silt loam, 6 to 10 percent slopes
-	HD	Harding silt loam
HeB		Hendricks silt loam, 1 to 6 percent slopes
HeD	-	Hendricks silt loam, 6 to 10 percent slopes
HeE		Hendricks silt loam, 10 to 20 percent slopes
HkD		Hendricks complex, 6 to 10 percent slopes
Ho	-	Honeyville silty clay loam
HpB		Hupp gravelly silt loam, 1 to 6 percent slopes
HpD		Hupp gravelly silt loam, 6 to 10 percent slopes
HuC		Hupp silt loam, 3 to 6 percent slopes
HuD		Hupp silt loam, 6 to 10 percent slopes
JaA	-	James Canyon loam, 0 to 3 percent slopes
KaE		Kapod stony loam, 6 to 20 percent slopes
KeB		Kearns silt loam, 1 to 3 percent slopes
KeC		Kearns silt loam, 3 to 6 percent slopes
KeD		Kearns silt loam, 6 to 10 percent slopes
KeE	-	Kearns silt loam, 10 to 20 percent slopes
KgD		Kearns-Stingal complex, 6 to 10 percent slopes
KhE	-	Kearns silt loam, high lime variant, 10 to 20 percent slopes
KlA	-	Kidman fine sandy loam, 0 to 2 percent slopes
KlB	-	Kidman fine sandy loam, 2 to 4 percent slopes
KmA	-	Kidman loam, 0 to 1 percent slopes
KmB		Kidman loam, 1 to 6 percent slopes
KmD		Kidman loam, 6 to 10 percent slopes
KmE		Kidman loam, 10 to 20 percent slopes
KnC	-	Kilburn gravelly sandy loam, 3 to 6 percent slopes
KnD		Kilburn gravelly sandy loam, 6 to 10 percent slopes
KnE		Kilburn gravelly sandy loam, 10 to 20 percent slopes
KnF	-	Kilburn gravelly sandy loam, 20 to 30 percent slopes
KnG	-	Kilburn gravelly sandy loam, 30 to 60 percent slopes
KoB	-	Kilburn gravelly loam, 1 to 3 percent slopes
Kr		Kirkham silt loam
-	LA	Lakeshore fine sandy loam
Lc	-	Lasil silt loam
Ld		Lasil silt loam, moderately alkali
Lr	-	Lasil-Airport silt loams
Ls	-	Lewiston fine sandy loam
Lt	-	Logan silty clay loam
	LUE	Lucky Star-Elzinga association, steep
Ma	-	Magna silty clay loam
MbC		Manila loam, 6 to 10 percent slopes
MbE	-	Manila loam, 10 to 25 percent slopes
	MCG	Manila loam, 25 to 60 percent slopes
	MDG	Manila-Smarts association, steep
Me		Martini fine sandy loam
-	MFB	Mellor silt loam, 1 to 6 percent slopes
	MGB	Mellor Thiokol silt loams, 1 to 6 percent slopes
MnB	-	Mendon silt loam, 1 to 6 percent slopes
MnD	-	Mendon silt loam, 6 to 10 percent slopes
	MIE	Middle cobbly silt loam, 10 to 30 percent slopes
-	MIG	Middle cobbly silt loam, 30 to 70 percent slopes
-	MJG	Middle-Broad association, steep
-	MKE	Middle-Rock outcrop complex, 10 to 30 percent slopes
	MKG	Middle-Rock outcrop complex, 30 to 60 percent slopes
MlA		Millville silt loam, 0 to 2 percent slopes
MlB		Millville silt loam, 2 to 4 percent slopes
MmB	-	Millville silt loam, moderately deep water table, 2 to 4 percent slopes
MuE	-	Munk gravelly silt loam, 10 to 20 percent slopes
-	OBE	Obray clay, 10 to 25 percent slopes
	PAB	Palisade silt loam, 1 to 6 percent slopes
-	PAD	Palisade silt loam, 6 to 10 percent slopes
PbA	-	Parleys loam, 0 to 3 percent slopes
PdA	-	Parleys loam, cool, 0 to 3 percent slopes
PeA	-	Parleys silt loam, 0 to 1 percent slopes
PeB	-	Parleys silt loam, 1 to 6 percent slopes
PeD	-	Parleys silt loam, 6 to 10 percent slopes
PeE	-	Parleys silt loam, 10 to 20 percent slopes
P.A		Parleys silty clay loam, 0 to 3 percent slopes
PmD	-	Parleys-Munk complex, 6 to 10 percent slopes
PmE		Parleys-Munk complex, 10 to 20 percent slopes
PnD	-	Parleys-Pomat silt loams, 6 to 10 percent slopes
-	POE	Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes
Pr		Payson silt loam
Ps	-	Peteetneet peat, moderately deep variant
-	PT	Placeritos silt loam
-	PU	Playas
	PVC	Pogal silt loam, rolling
PwD		Pomat silt loam, 6 to 10 percent slopes
PwE		Pomat silt loam, 10 to 30 percent slopes
PwG2	-	Pomat silt loam, 30 to 40 percent slopes, eroded
PxE	-	Pomat-Kearns silt loams, 10 to 30 percent slopes
PyE		Pomat-Parleys silt loams, 10 to 30 percent slopes
RaA	-	Red Rock silt loam, high rainfall, 0 to 3 percent slopes
ReA	-	Red Rock silt loam, 0 to 1 percent slopes
ReB	-	Red Rock silt loam, 1 to 6 percent slopes
Rf	-	Refuge loam
	RMG2	Richmond-Middle complex, 30 to 70 percent slopes, eroded
RrE	-	Ridd-Rock outcrop complex, 10 to 30 percent slopes
RrG	-	Ridd-Rock outcrop complex, 30 to 70 percent slopes
-	RS	Rock land
-	RT	Rock outcrop
Ru		Roshe Springs silt loam
Rv	-	Rough broken land
-	RWG	Rozlee-Rock outcrop complex, 30 to 70 percent slopes
-	SA	Saltair silty clay loam
	SB	Saltair-Fresh water marsh association
-	SC	Saltair-Logan association
Sa	-	Saltair-Refuge complex
-	SEE	Sandall cobbly silt loam, 10 to 30 percent slopes
-	SEG	Sandall cobbly silt loam, 30 to 60 percent slopes
-	SFG	Sandall-Broad association, steep
-	SGG	Sandall Promo association, steep
-	SHE	Sandall-Rock outcrop complex, 3 to 30 percent slopes
	SJG	Sandall-Rozlee association, steep
SkE		Sanpete gravelly silt loam, 6 to 30 percent slopes
SlB	-	Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes
SlD	-	Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes
SlE	-	Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes
SlG		Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes
-	SMB	Saxby-Thiokol complex, 1 to 6 percent slopes
	SN	Saxby-Very stony land association
SoD	-	Sheeprock gravelly sandy loam, 6 to 10 percent slopes
SpF3		Sheeprock gravelly loam, 10 to 40 percent slopes, severely eroded
	SQG	Smarts loam, 30 to 70 percent slopes
SrE		Snowville gravelly silt loam, 6 to 20 percent slopes
SsB		Sterling gravelly loam, 1 to 6 percent slopes
SsD	-	Sterling gravelly loam, 6 to 20 percent slopes
SsF	-	Sterling gravelly loam, 20 to 30 percent slopes
SsG	-	Sterling gravelly loam, 30 to 50 percent slopes
StE		Sterling very stony loam, 10 to 30 percent slopes
SuE	-	Sterling-Parleys complex, 6 to 20 percent slopes
SvB	-	Stingal loam, 1 to 6 percent slopes
SvD	-	Stingal loam, 6 to 10 percent slopes
Sw	-	Stokes silt loam
Sx		Stony alluvial land
Sy		Sunset silt loam
Sz	-	Syracuse fine sandy loam
ThA		Thiokol silt loam, 0 to 1 percent slopes
ThB	-	Thiokol silt loam, 1 to 6 percent slopes
ThD		Thiokol silt loam, 6 to 10 percent slopes
TkA		Thiokol silt loam, low rainfall, 0 to 1 percent slopes
TkB	-	Thiokol silt loam, low rainfall, 1 to 3 percent slopes
TmA		Timpanogos loam, 0 to 3 percent slopes
TmB		Timpanogos loam, 3 to 6 percent slopes
TnA	-	Timpanogos loam, cool, 0 to 3 percent slopes
ToB	-	Timpanogos silt loam, 1 to 6 percent slopes
ToC		Timpanogos silt loam, 6 to 10 percent slopes
	UF	Uffens silt loam
	VS	Very stony land
Wa		Warm Springs fine sandy loam
WcC		Wasatch gravelly sandy loam, 3 to 10 percent slopes
WcE		Wasatch gravelly sandy loam, 10 to 25 percent slopes
WdG	-	Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes
WeE	-	Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes
WhG		Wheelon silt loam, 30 to 60 percent slopes
WlG	-	Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes
WmE	-	Wheelon-Collinston silt loams, 10 to 30 percent slopes
WnB		Windmill gravelly loam, 1 to 6 percent slopes
WnD	-	Windmill gravelly loam, 6 to 10 percent slopes
WnE		Windmill gravelly loam, 10 to 20 percent slopes
Wc	-	Woods Cross silty clay loam
Wr	-	Woods Cross silty clay loam, moderately saline
	YHE	Yeates Hollow cobbly clay loam, 20 to 30 percent slopes
-	YHG	Yeates Hollow cobbly clay loam, 30 to 60 percent slopes
	YRE	Yeates Hollow-Goring association, steep

* The composition of these units is more variable than that of the others in the survey area but has been controlled well enough to interpret for the expected use of the soils.

BOX ELDER COUNTY, EASTERN PART, UTAH

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Divided
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State or county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings

- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Corral

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Soil Survey
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds

- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

Well, irrigation

Well, artesian

Flume

Siphon

RELIEF

Escarpments

- Bedrock
- Other

Short steep slope

Prominent peak

SOIL SURVEY DATA

Soil boundary and symbol (Dx)

Gravel

Stoniness

- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Overblown soil

Windhum mock

Saline spot

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 1

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 1

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 2

N

Scale 1:20 000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 1)

(Joins sheet 3)

T. 14 N. | T. 15 N.

(Joins sheet 12)

R. 10 W. | R. 9 W.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

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3

N

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 3

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Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.

T. 14 N. | T. 15 N.

(Joins sheet 2)

(Joins sheet 4)

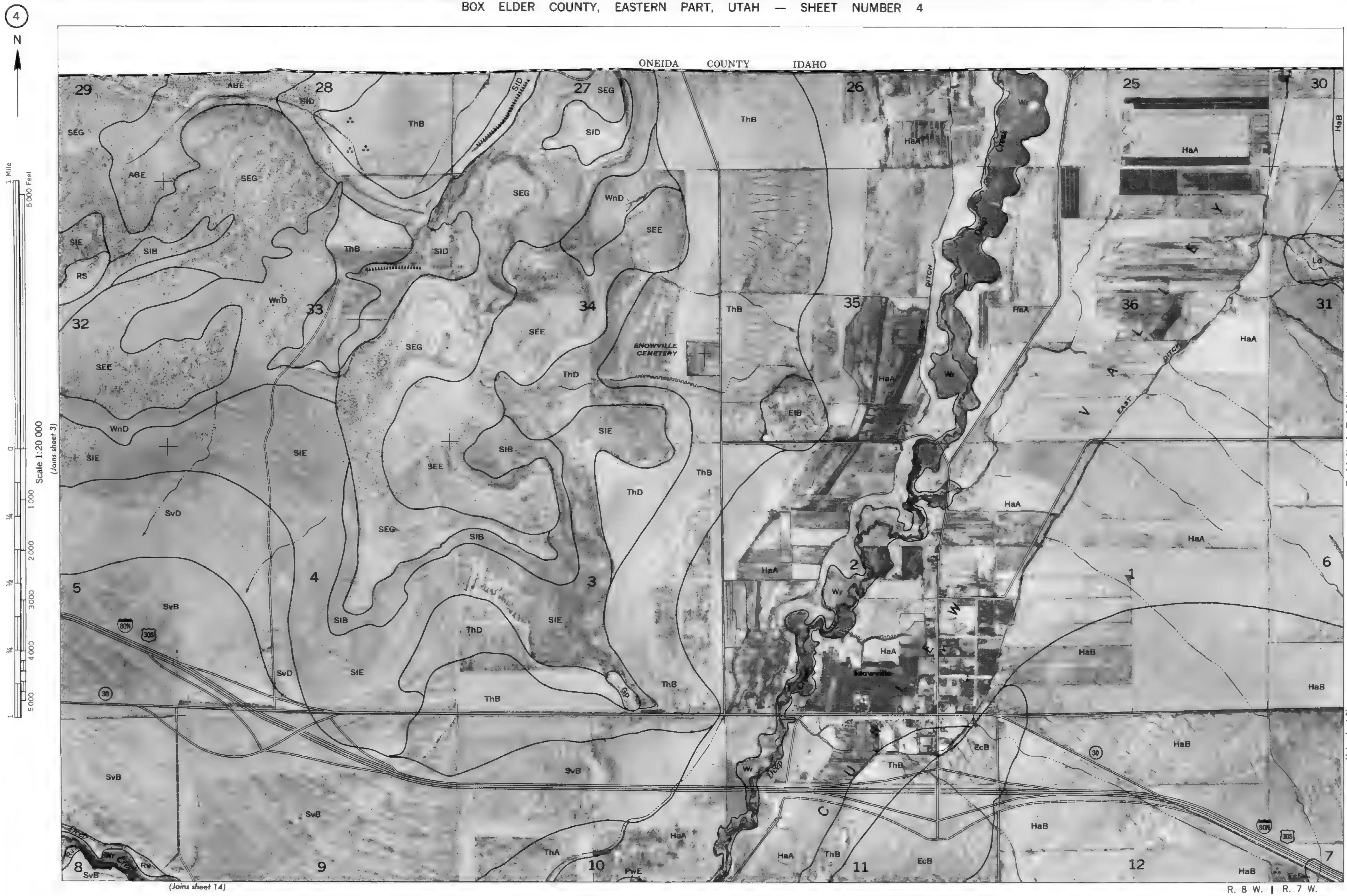
1 Mile

5 000 Feet

Scale 1:20 000

R. 9 W. | R. 8 W.

(Joins sheet 13)



Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(5)

N

T. 14 N. | T. 15 N.

(Joins sheet 4)

(Joins sheet 6)

R. 7 W.

(Joins sheet 15)

1 Mile
5000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 5

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 6

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

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BOX ELDER COUNTY, EASTERN PART, UTAH NO. 7

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Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 8

N

(Joins sheet 7)

(Joins sheet 9)

(Joins sheet 18)

R. 5 W. | R. 4 W.

T. 14 N. | T. 15 N.

1 Mile

5000 Feet

Scale 1:20 000

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Land division corners are approximately positioned on this map.

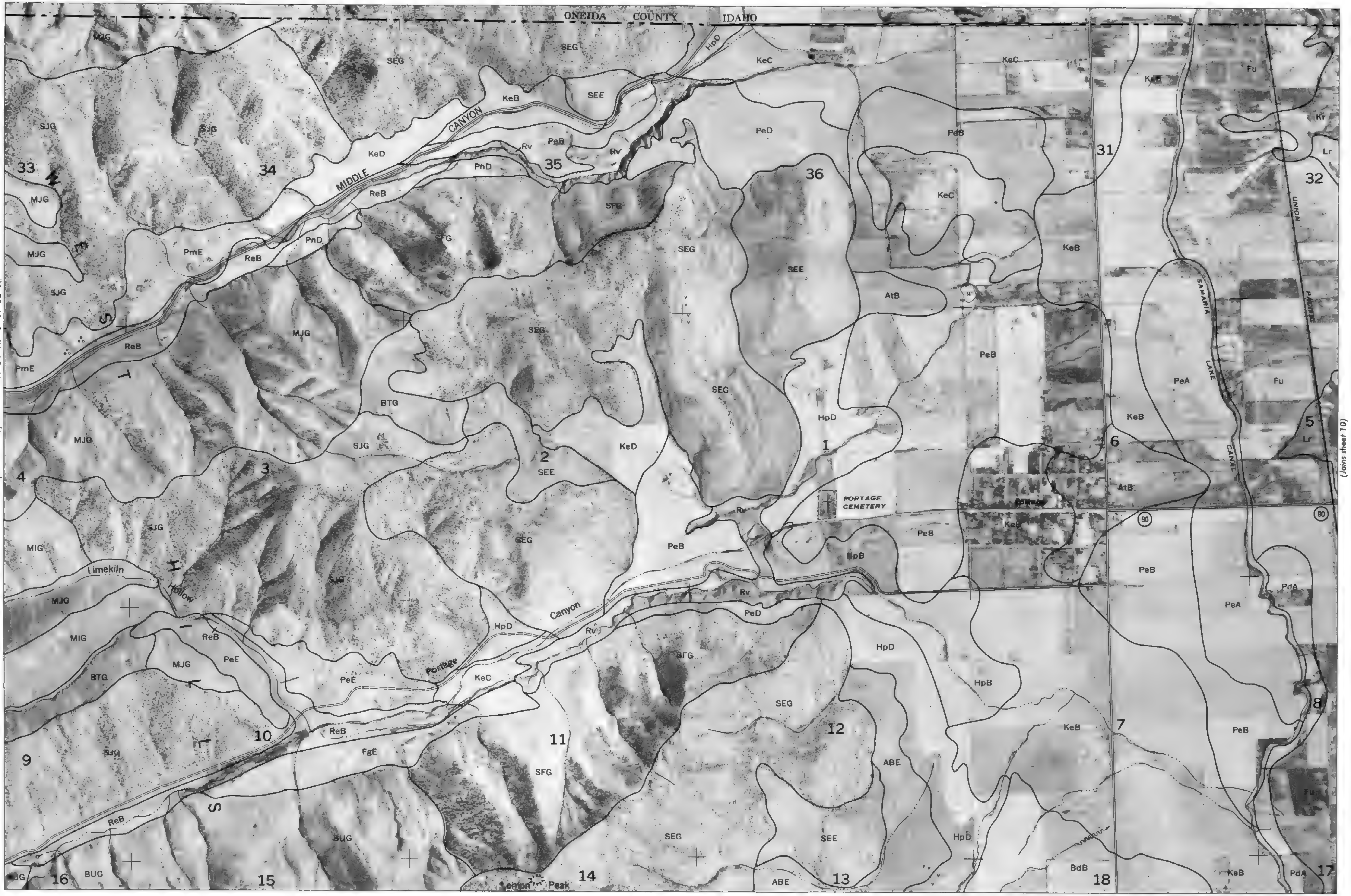
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 8

9

N



T. 14 N. | T. 15 N.

(Joins sheet 8)

(Joins sheet 10)

R. 4 W. | R. 3 W.

(Joins sheet 19)

1 Mile

5000 Feet

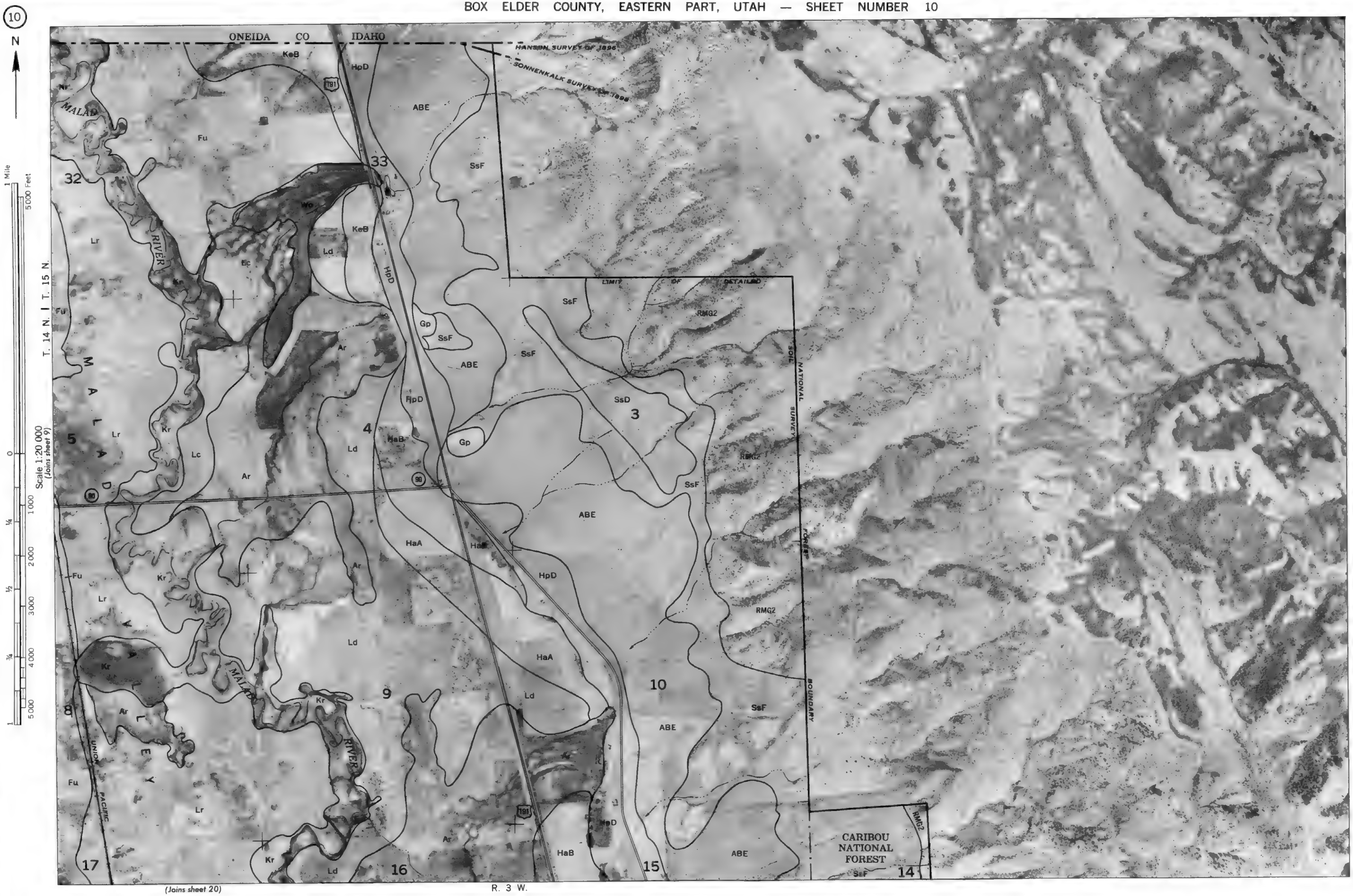
Scale 1:20 000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 9

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 1)

11

1 Mile
5000 Feet
0
0
¼
1000
2000
½
3000
¾
4000
5000
1
Scale 1:20 000

T. 14 N.

(Joins sheet 12)

R. 10 W.

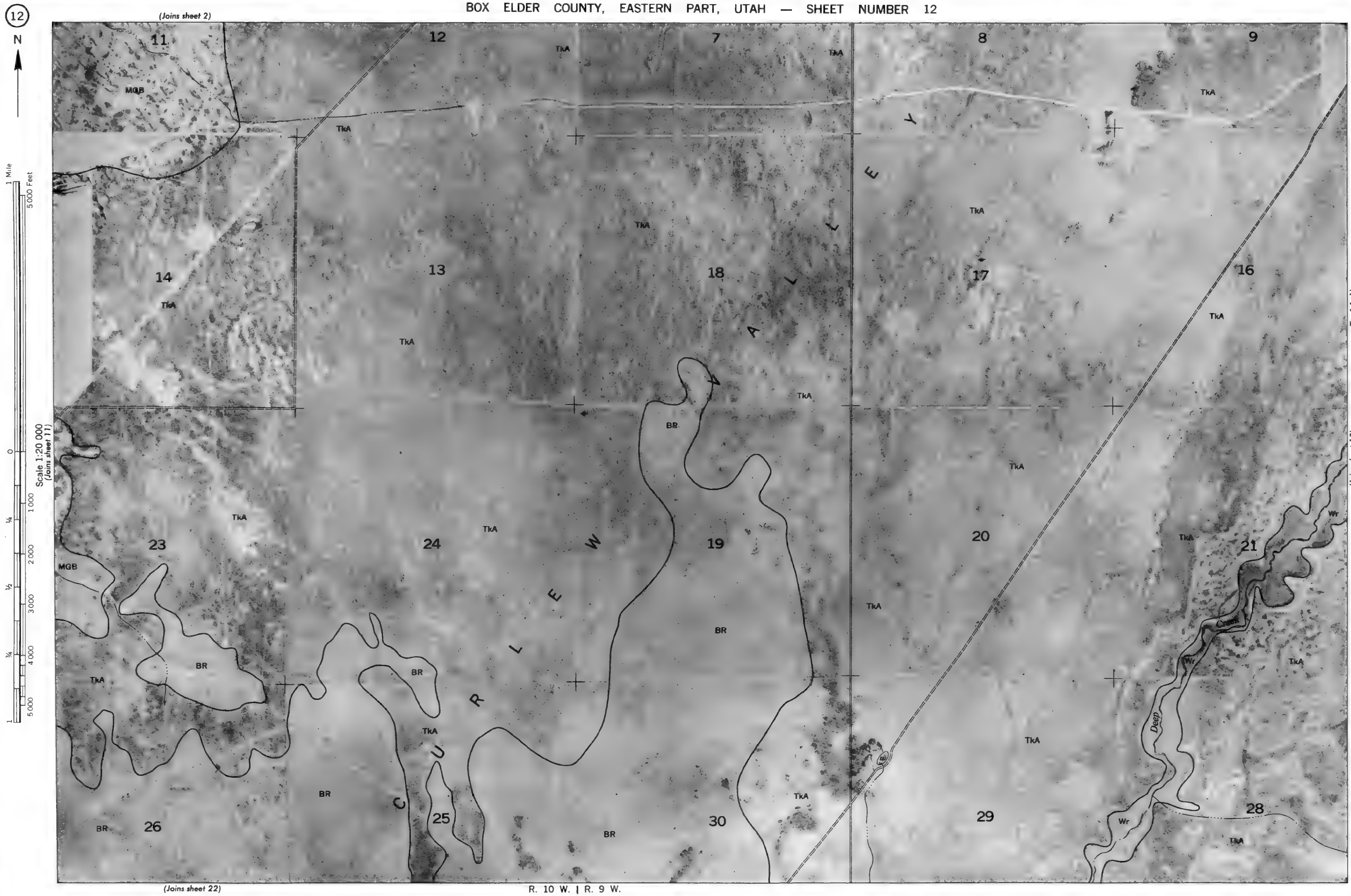
(Joins sheet 21)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 11

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

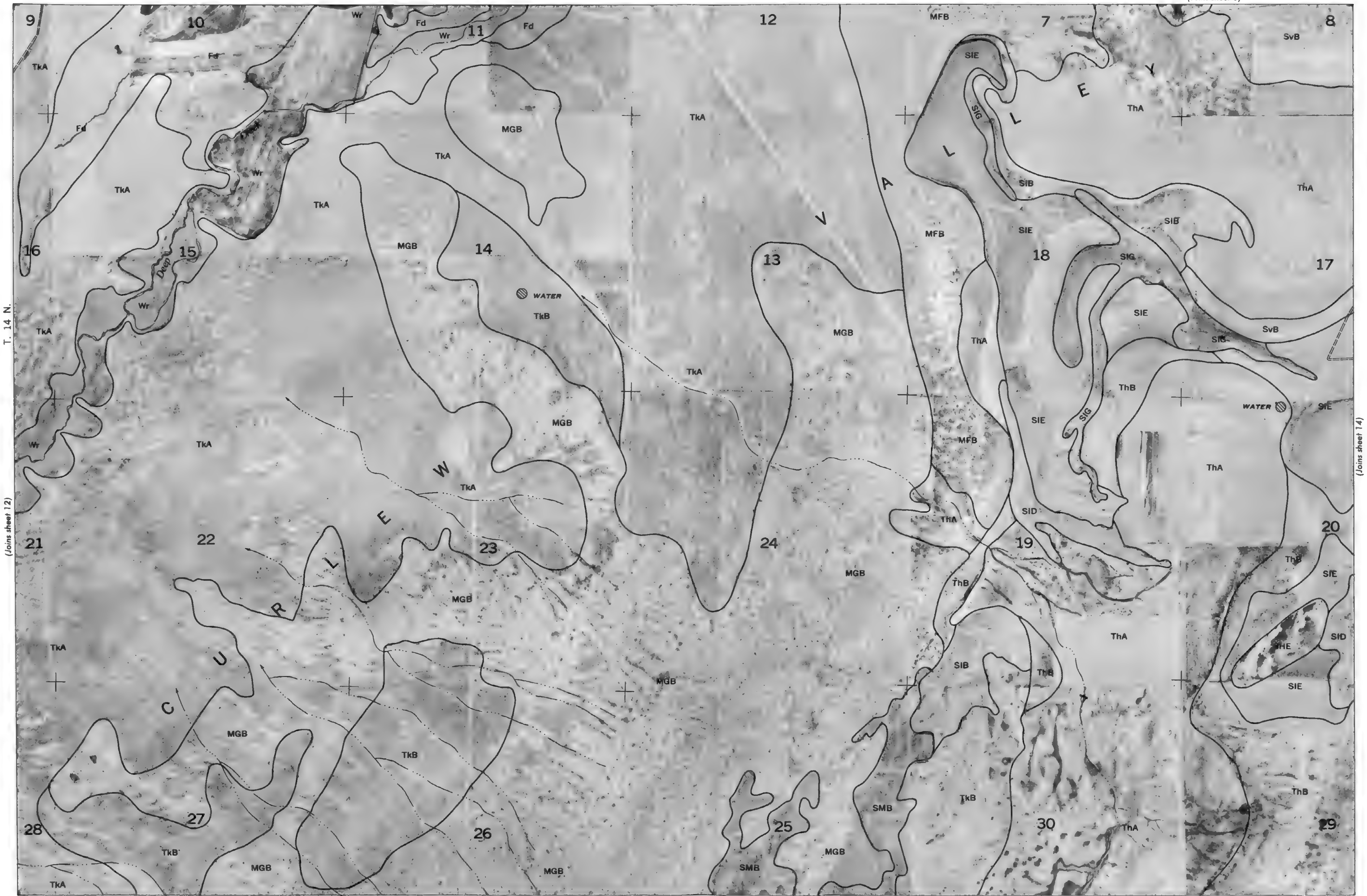
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of the Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 3)



(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 23)

T. 14 N.

R. 9 W. | R. 8 W.

13

N

1 Mile | 5000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000

0 | ¼ | ½ | ¾ | 1

Scale 1:20 000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 13

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 14

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
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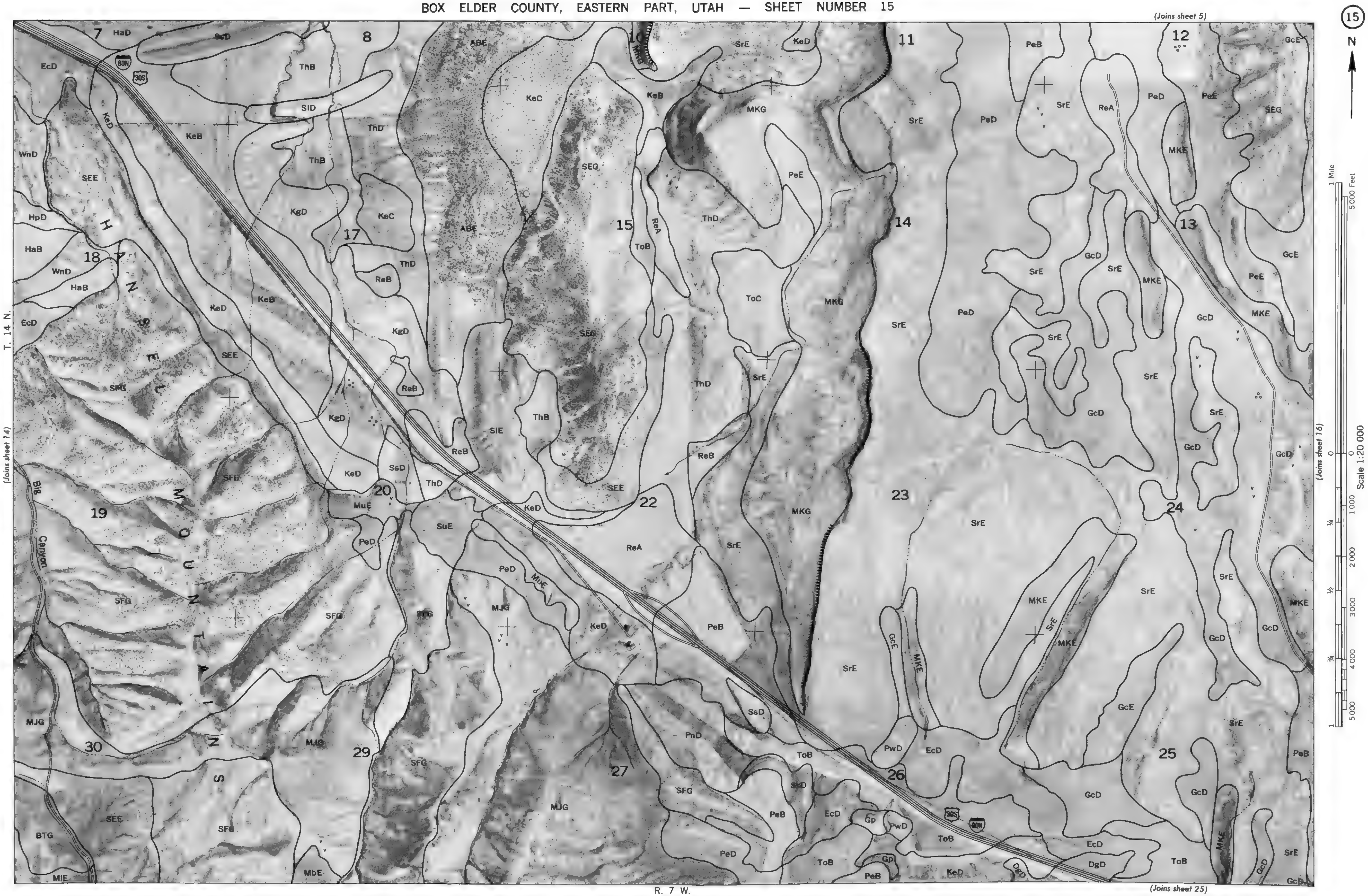
BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 15



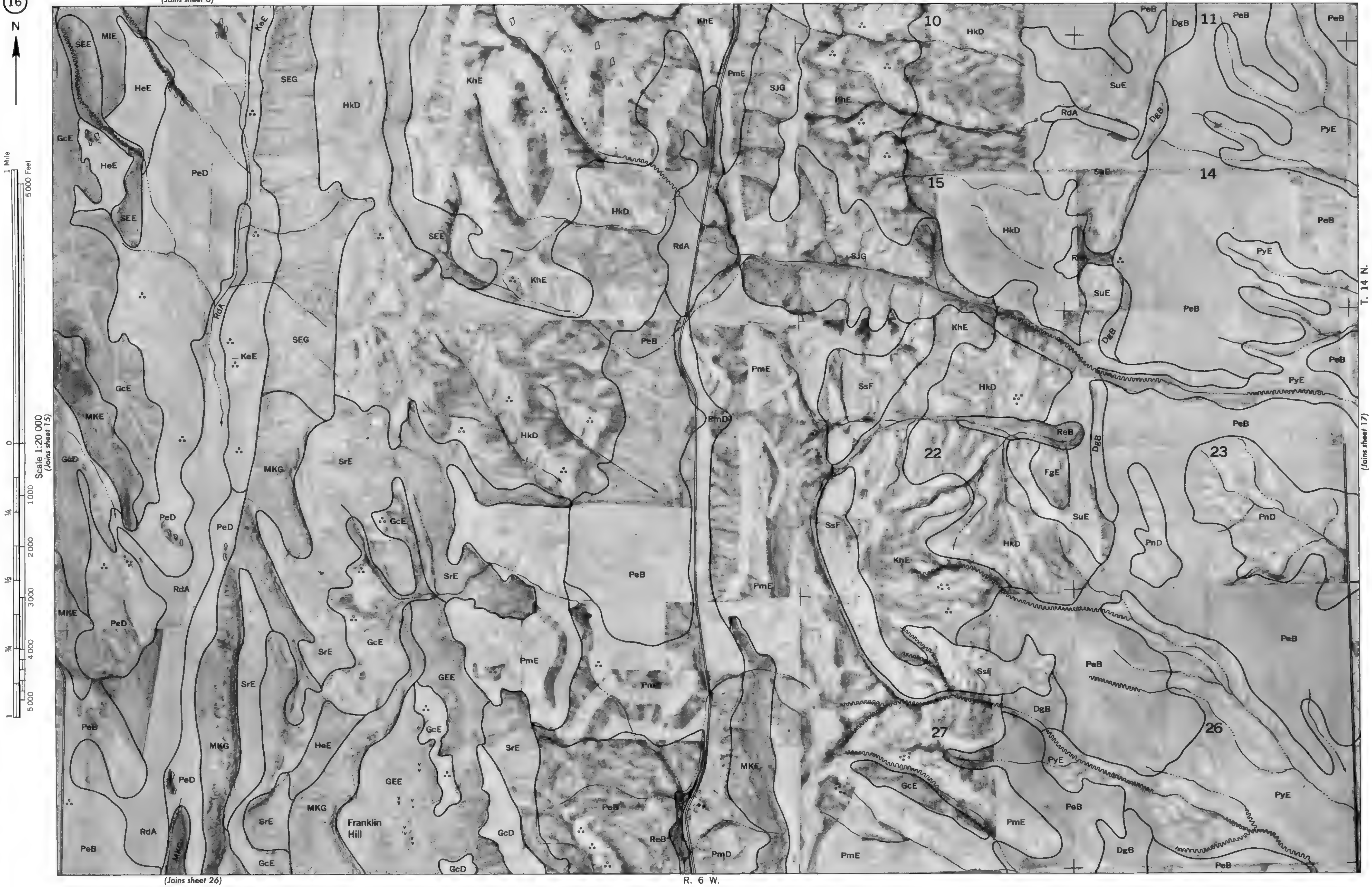
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 15

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 16



Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 16

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 17

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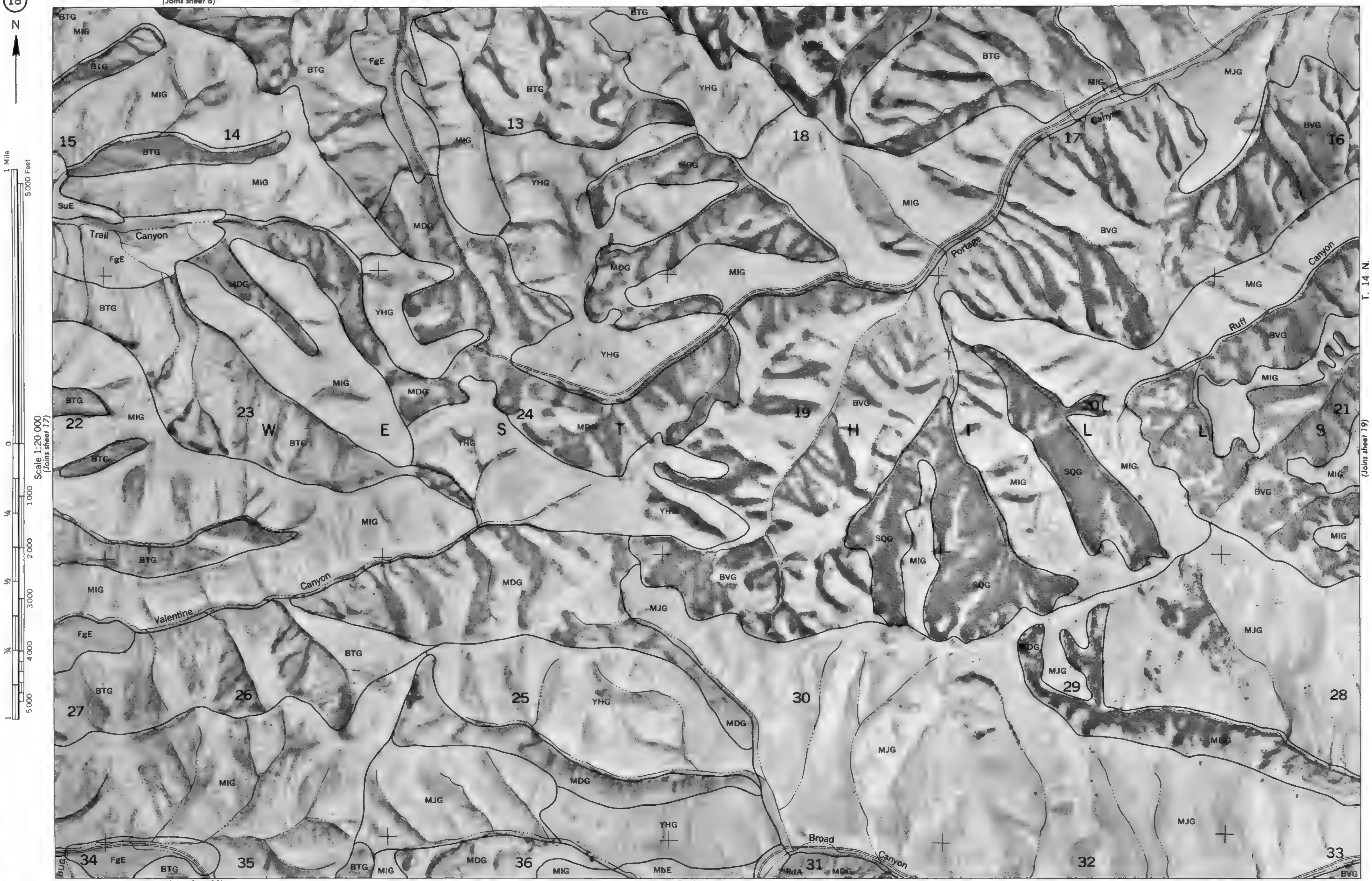
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 18

(Joins sheet 8)



(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 28)

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management; and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 19

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 20

(Joins sheet 10)

R. 3 W.

T. 14 N.

(Joins sheet 19)

Scale 1:20 000

1 Mile
5 000 Feet

(Joins sheet 30)

(Joins inset, sheet 31)

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 11)

21

R. 10 W.

(Joins sheet 32)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 21

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

(22)

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 22

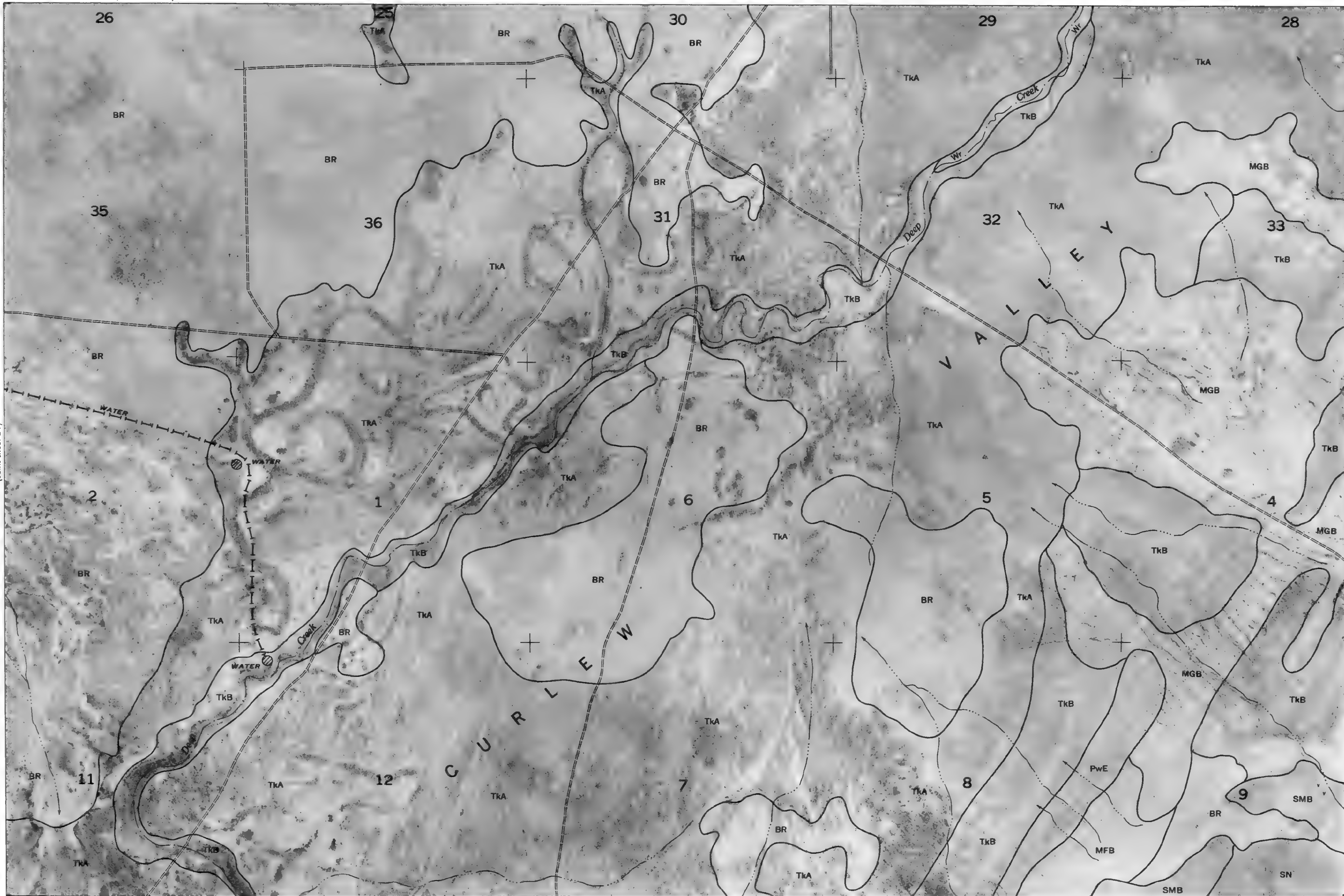
(Joins sheet 12)

N

1 Mile | 5 000 Feet | 0 | 1 000 | ¼ | 2 000 | ½ | 3 000 | ¾ | 4 000 | 1 | 5 000

Scale 1:20 000

(Joins sheet 21)



(Joins sheet 23)

(Joins sheet 33)

R. 10 W. | R. 9 W.

T. 13 N. | T. 14 N.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

23

(Joins sheet 13)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 34)

R. 9 W. | R. 8 W.

N

1 Mile

5000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 23

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

N

R. 8 W. | R. 7 W.

(Joins sheet 14)

Scale 1:20 000
1 Mile
5000 Feet
0
1/4
1/2
3/4
1
1 000
2 000
3000
4000
5000

(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 35)

T. 14 N. | T. 13 N.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(25)

(Joins sheet 15)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 25
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.
Photobase from 1959 aerial photography.
Land division corners are approximately positioned on this map.

(Joins sheet 24)

(Joins sheet 26)

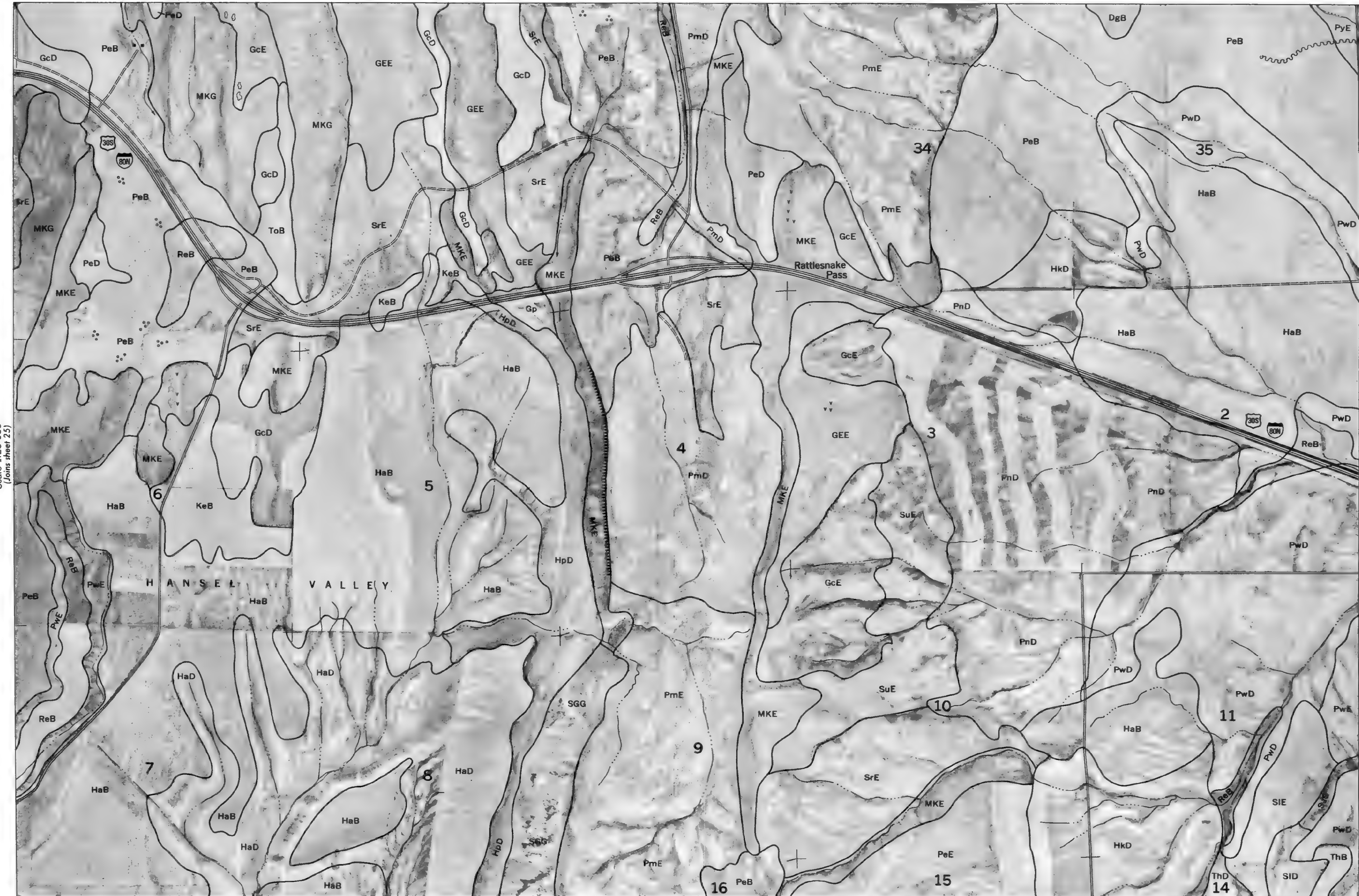
R. 7 W.

(Joins sheet 36)

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 26

N

(Joins sheet 16)



Scale 1:20 000

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

(Joins sheet 37)

R. 6 W.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

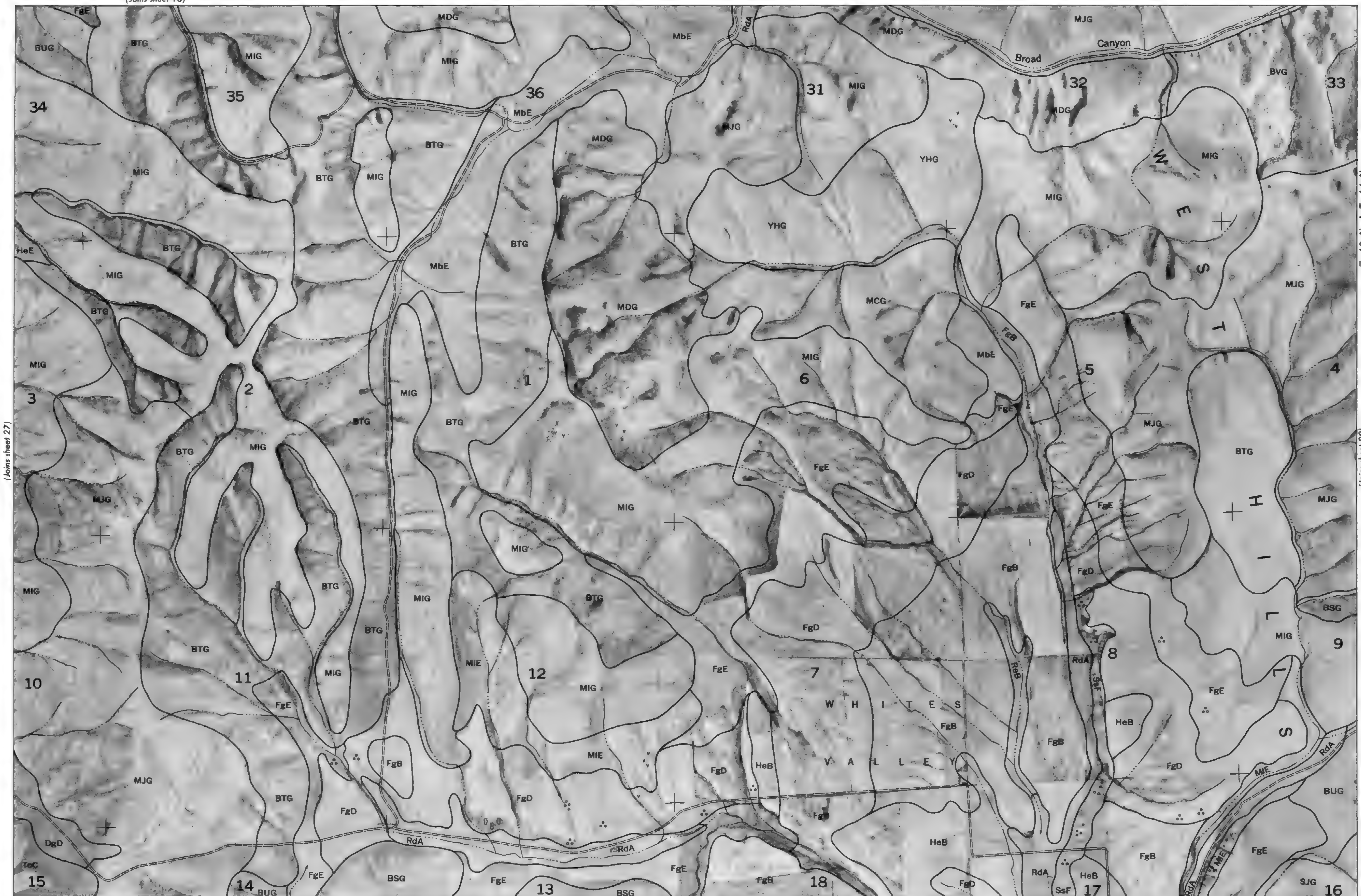
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 26

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 27
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.
Photobase from 1959 aerial photography.
Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 28

N

(Joins sheet 18)



Scale 1:20 000

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

(Joins sheet 27)

(Joins sheet 29)

T. 13 N. | T. 14 N.

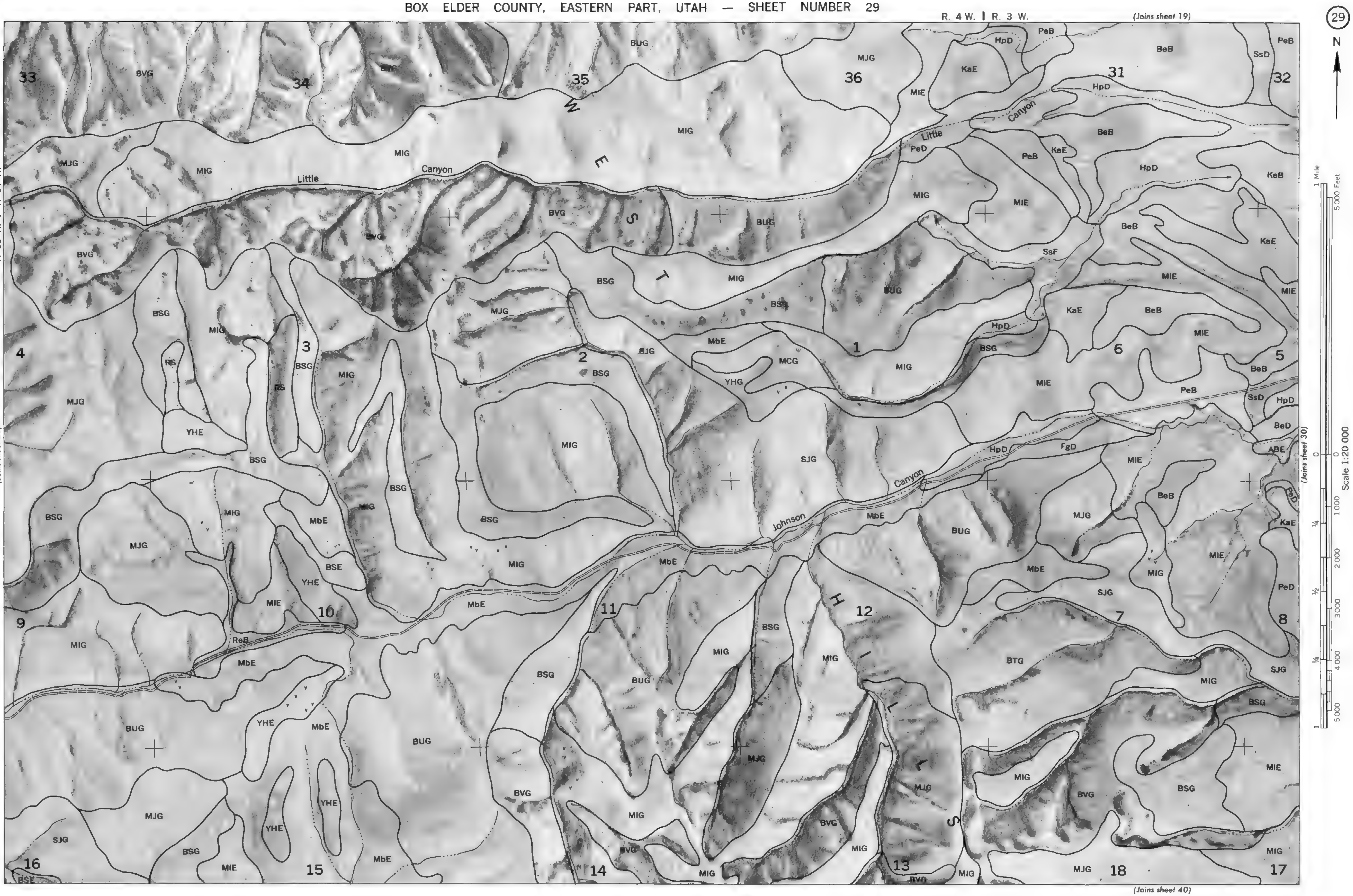
(Joins sheet 39)

R. 5 W. | R. 4 W.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of the Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

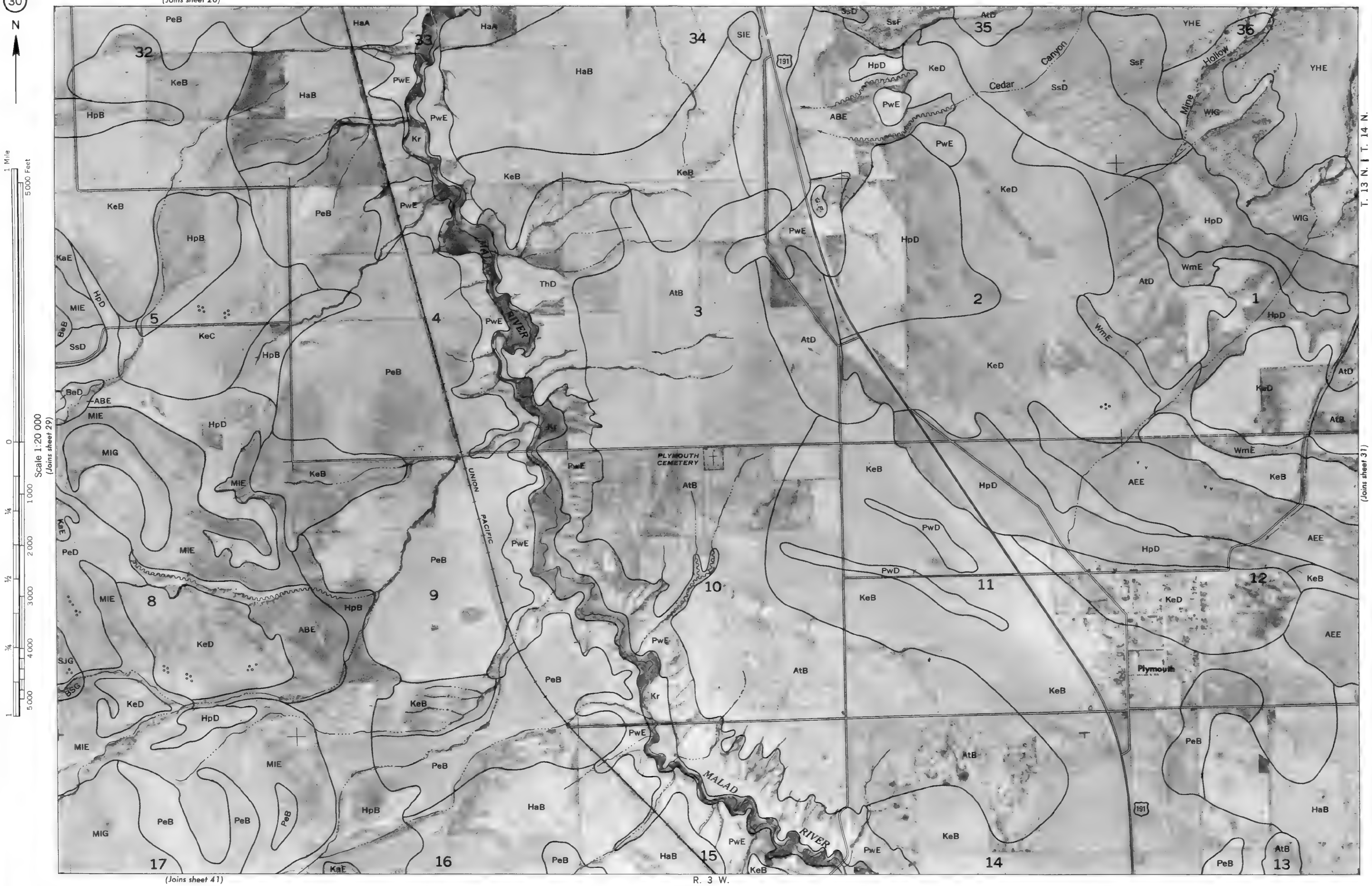


BOX ELDER COUNTY, EASTERN PART, UTAH NO. 29

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

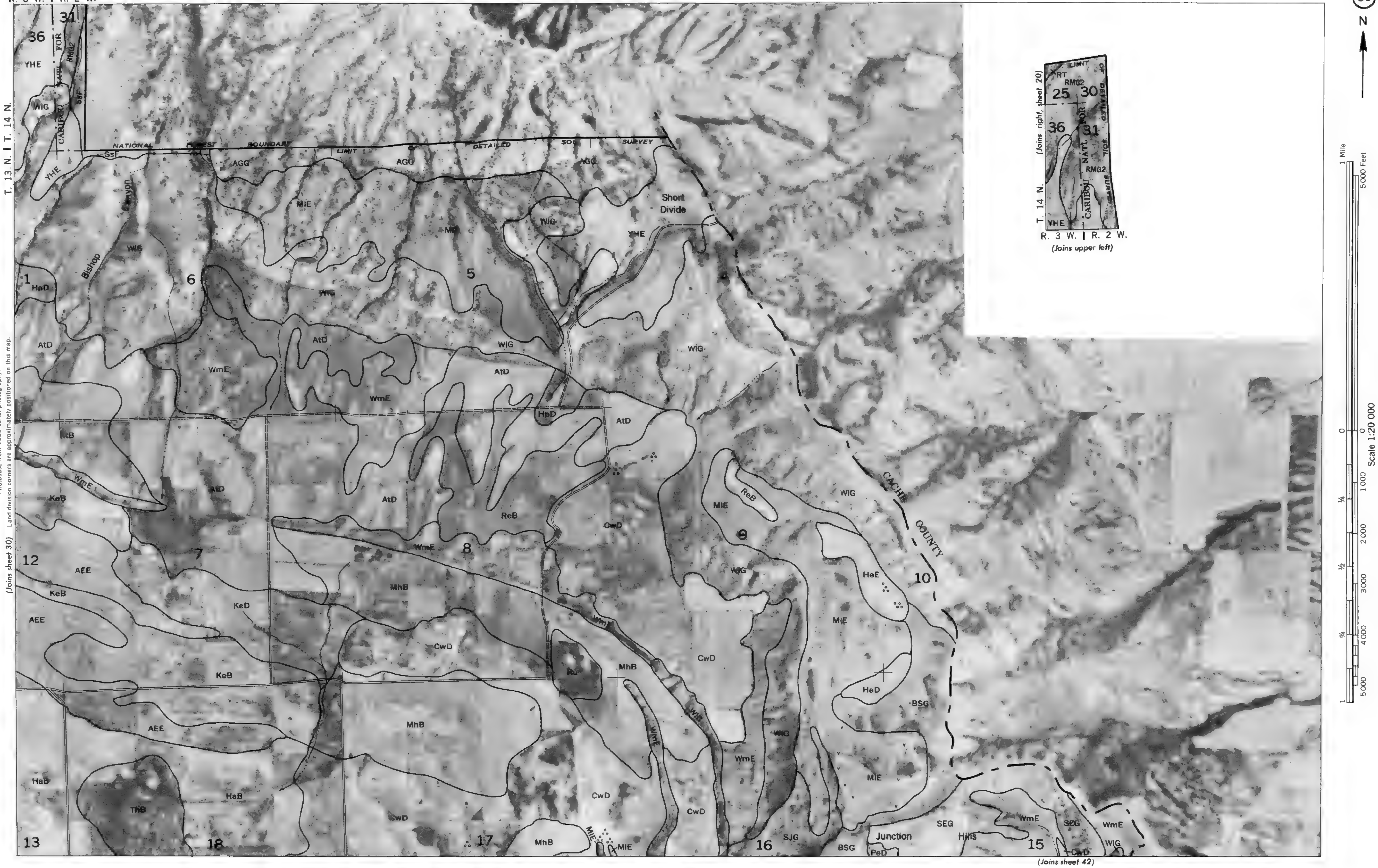


Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins inset)

R. 3 W. | R. 2 W.

T. 14 N. | T. 13 N.



(Joins sheet 42)

(Joins sheet 30)

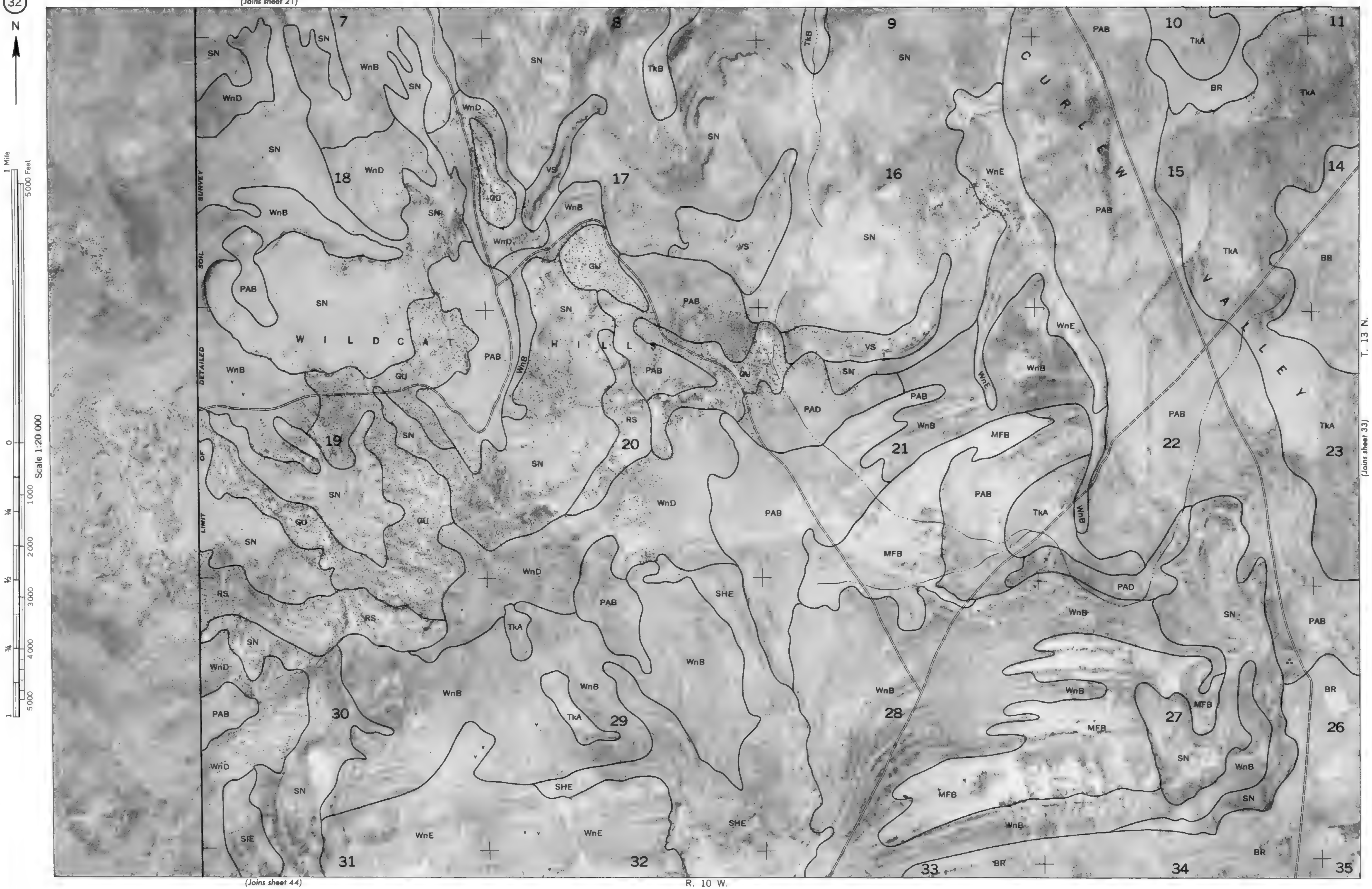
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 31

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 32

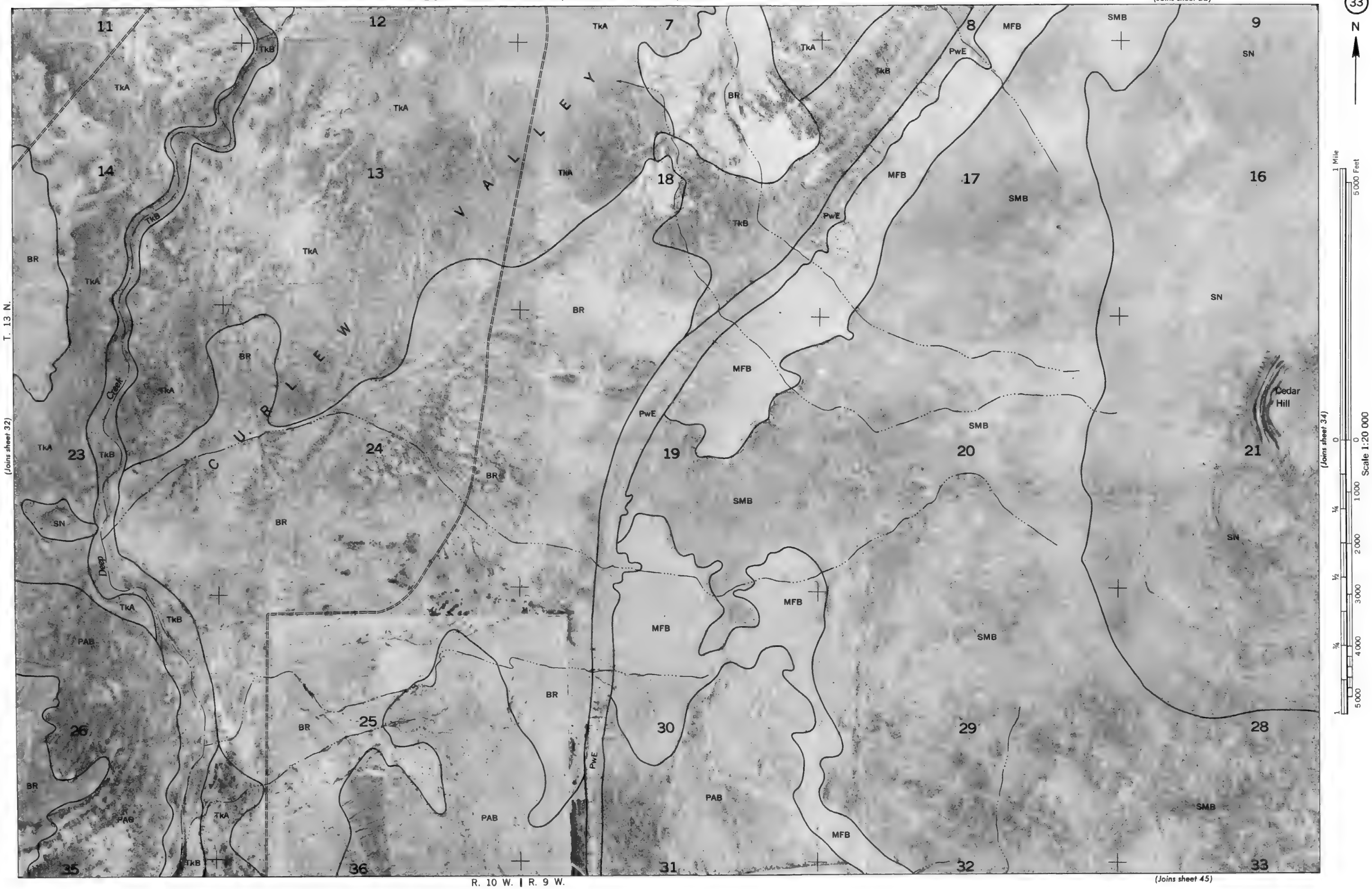


This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 33



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 33

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

34

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.

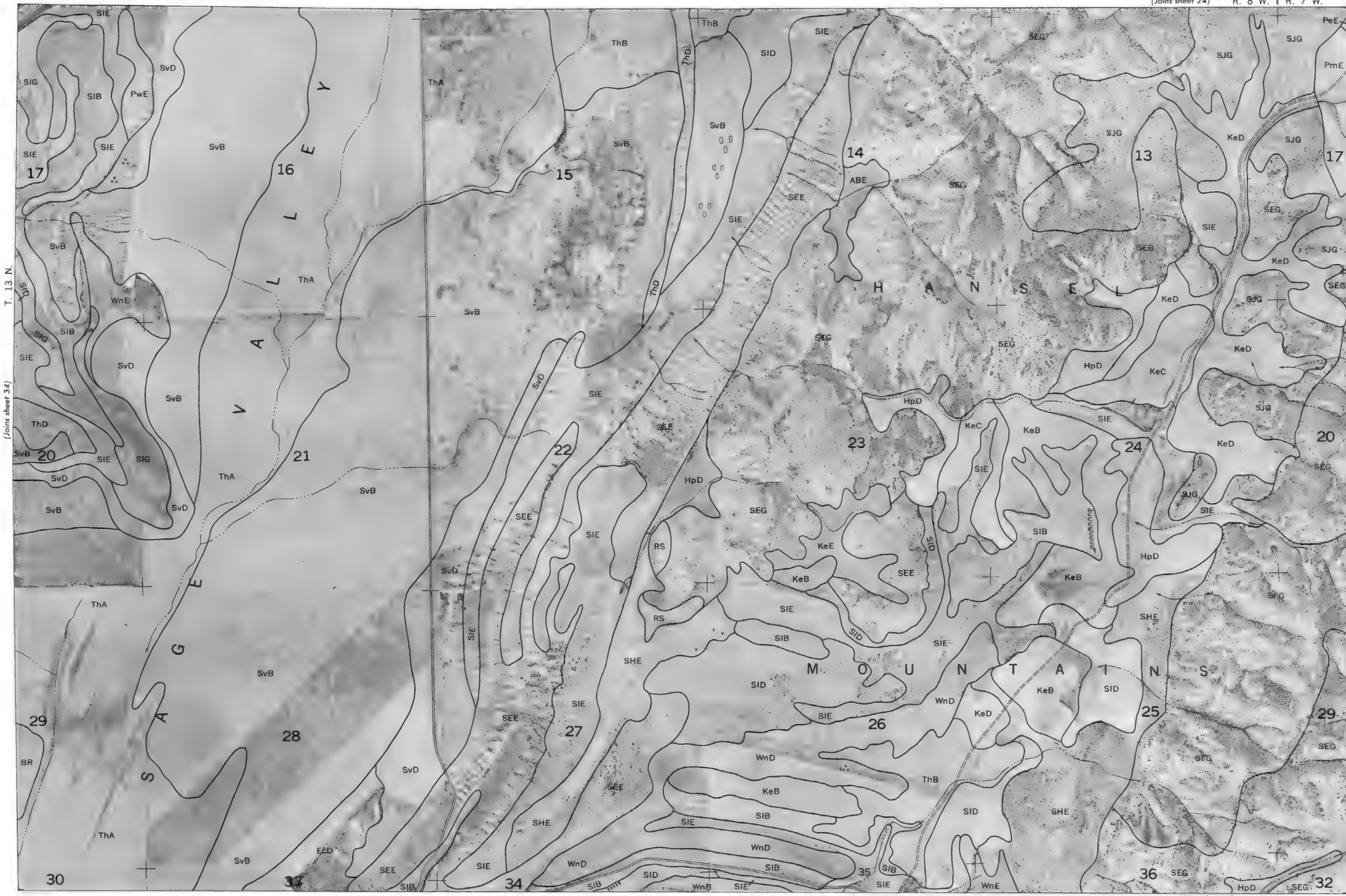
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(35)

(Joins sheet 24) R. 8 W. | R. 7 W.

T. 13 N.

(Joins sheet 34)



(Joins sheet 36)

N

1 Mile

5000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

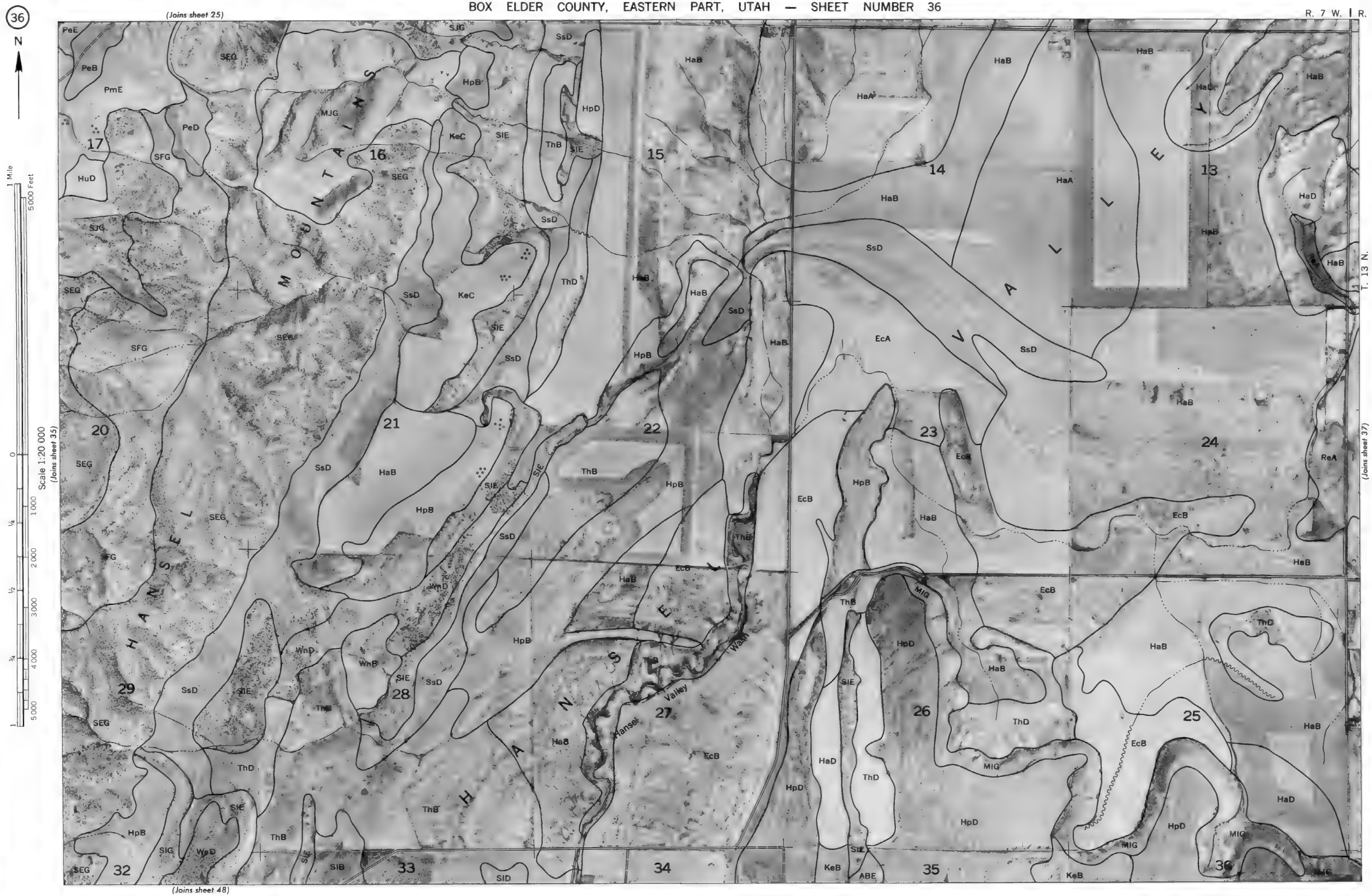
(Joins sheet 47)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 35

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

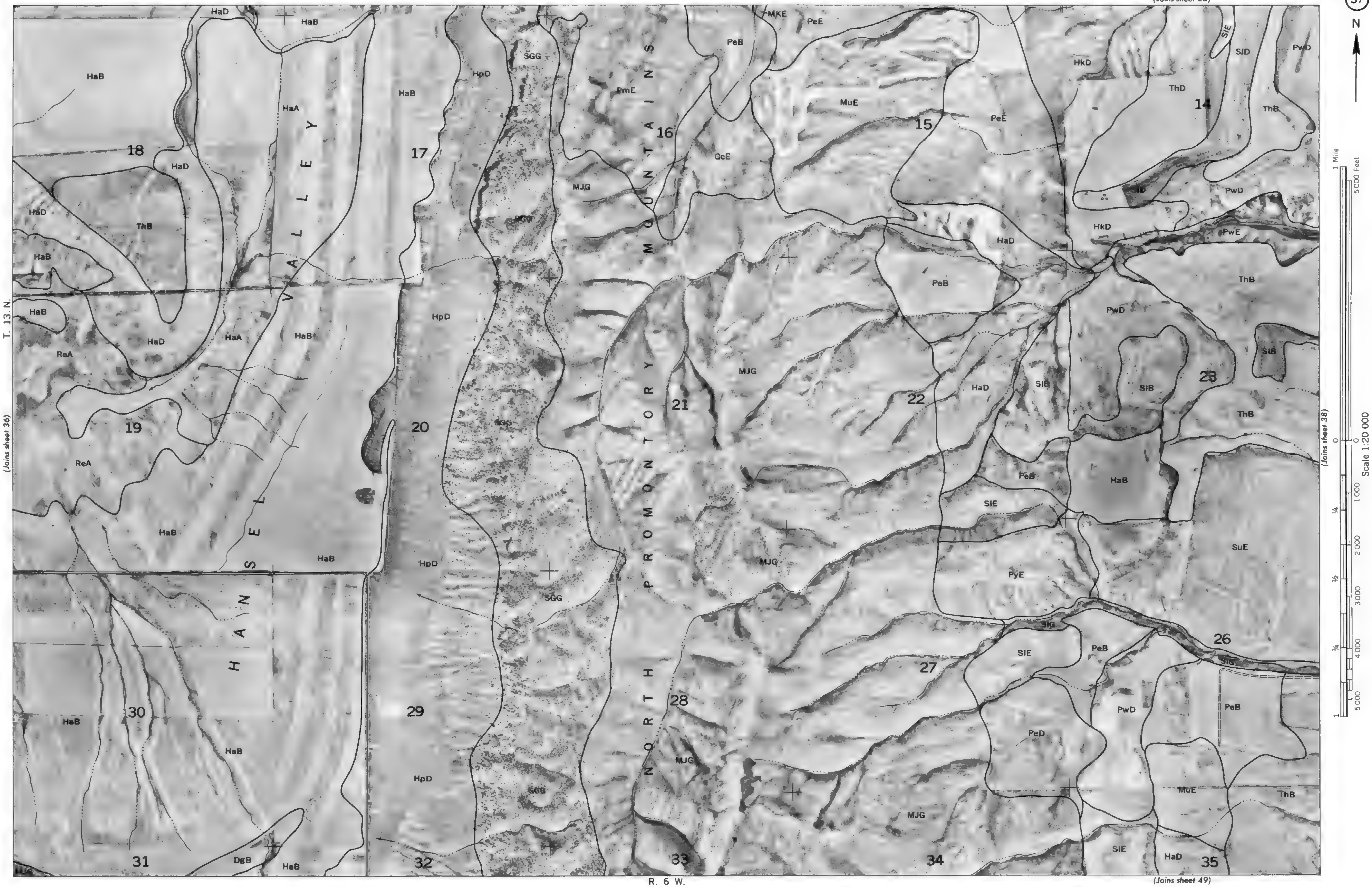
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 37



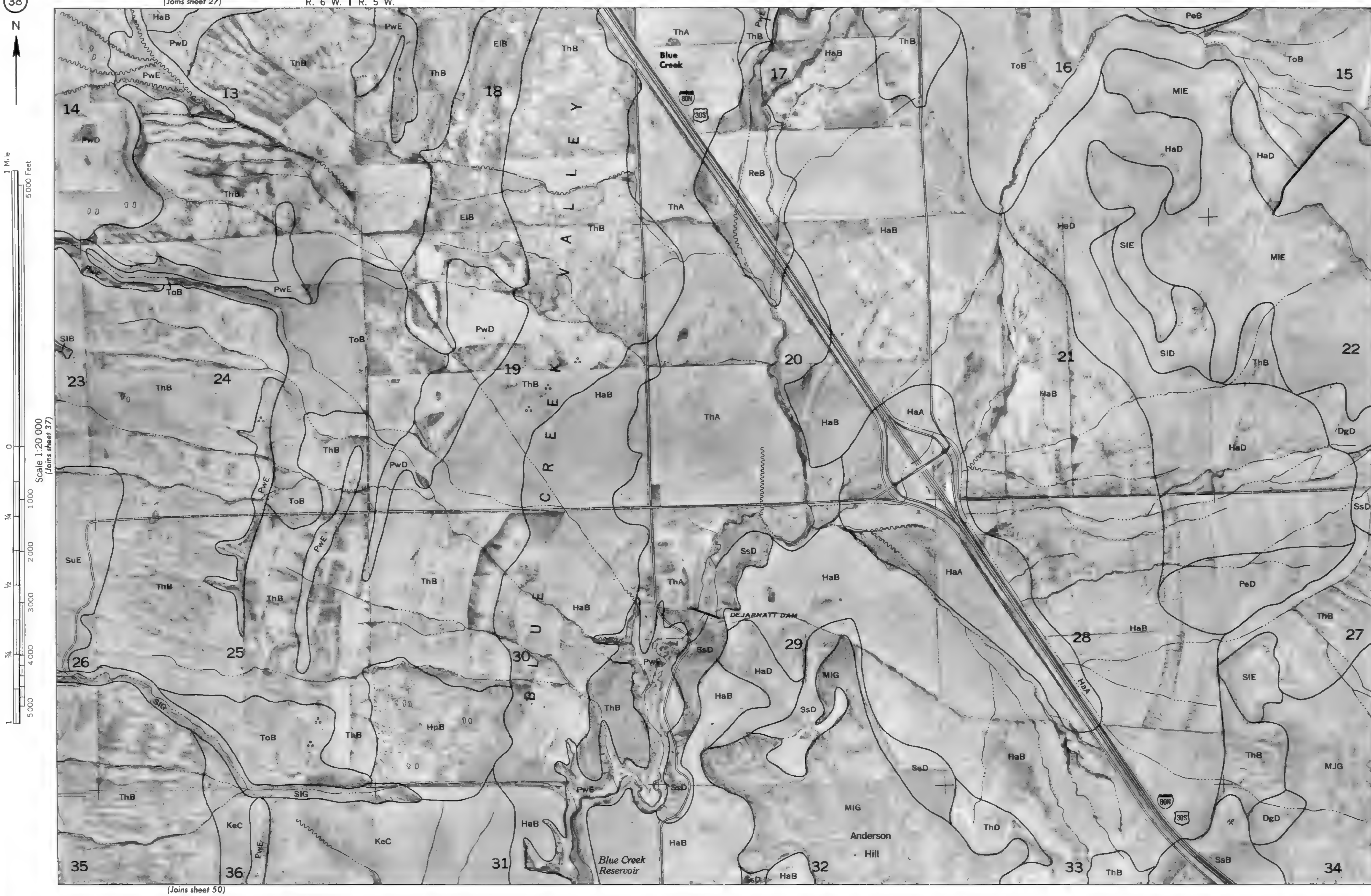
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 37

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

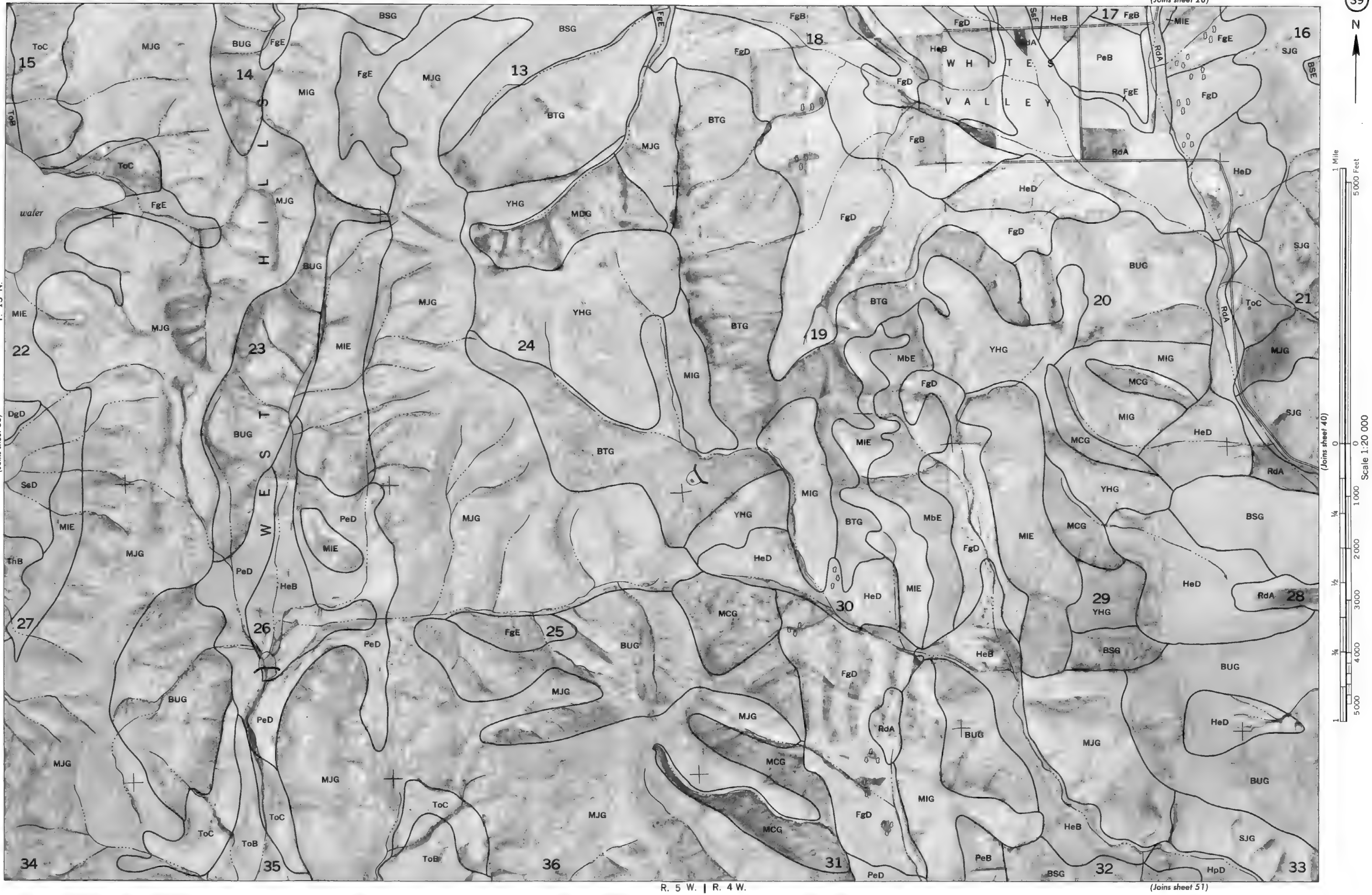
(38)



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.



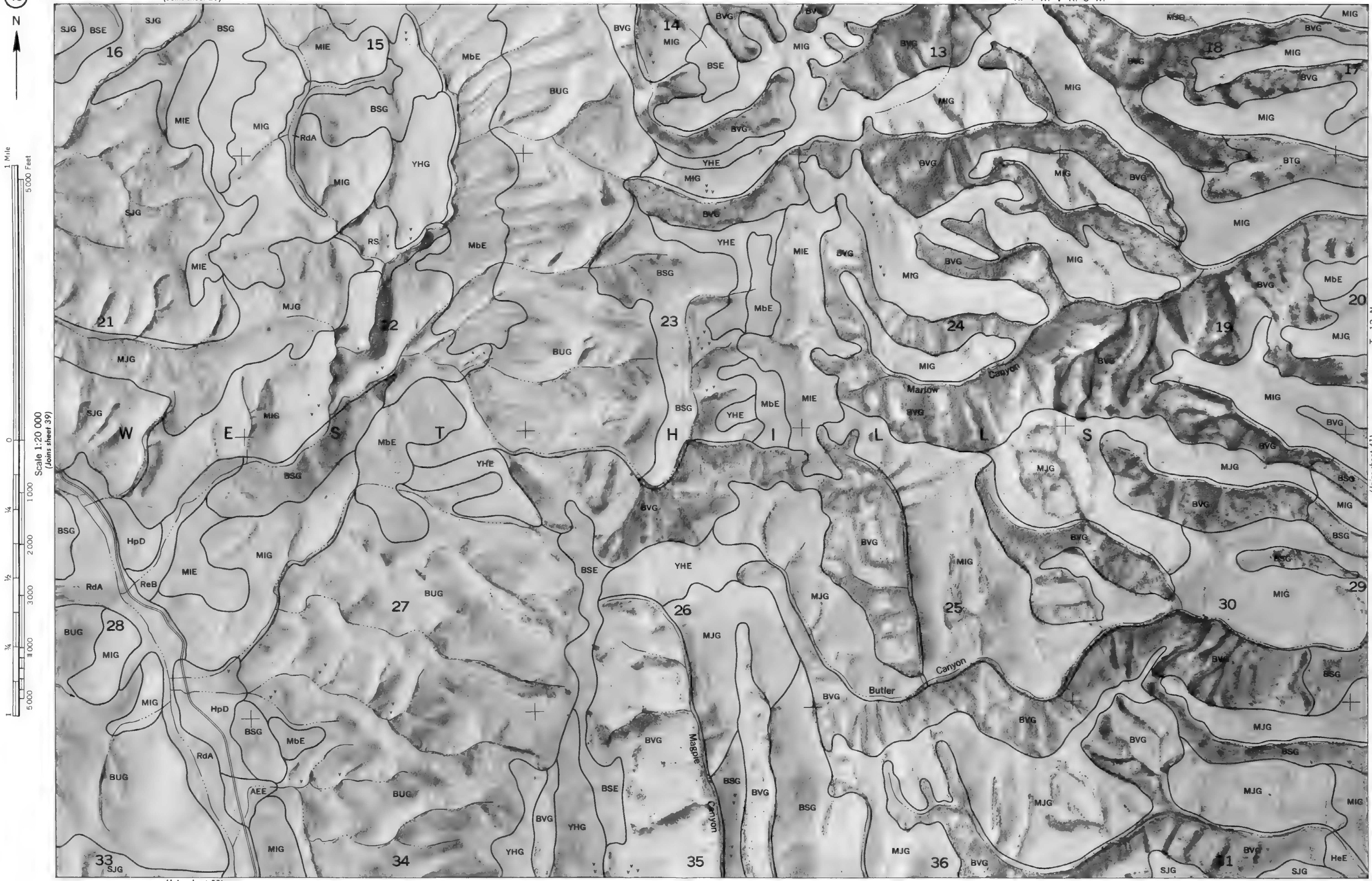
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 39

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 40



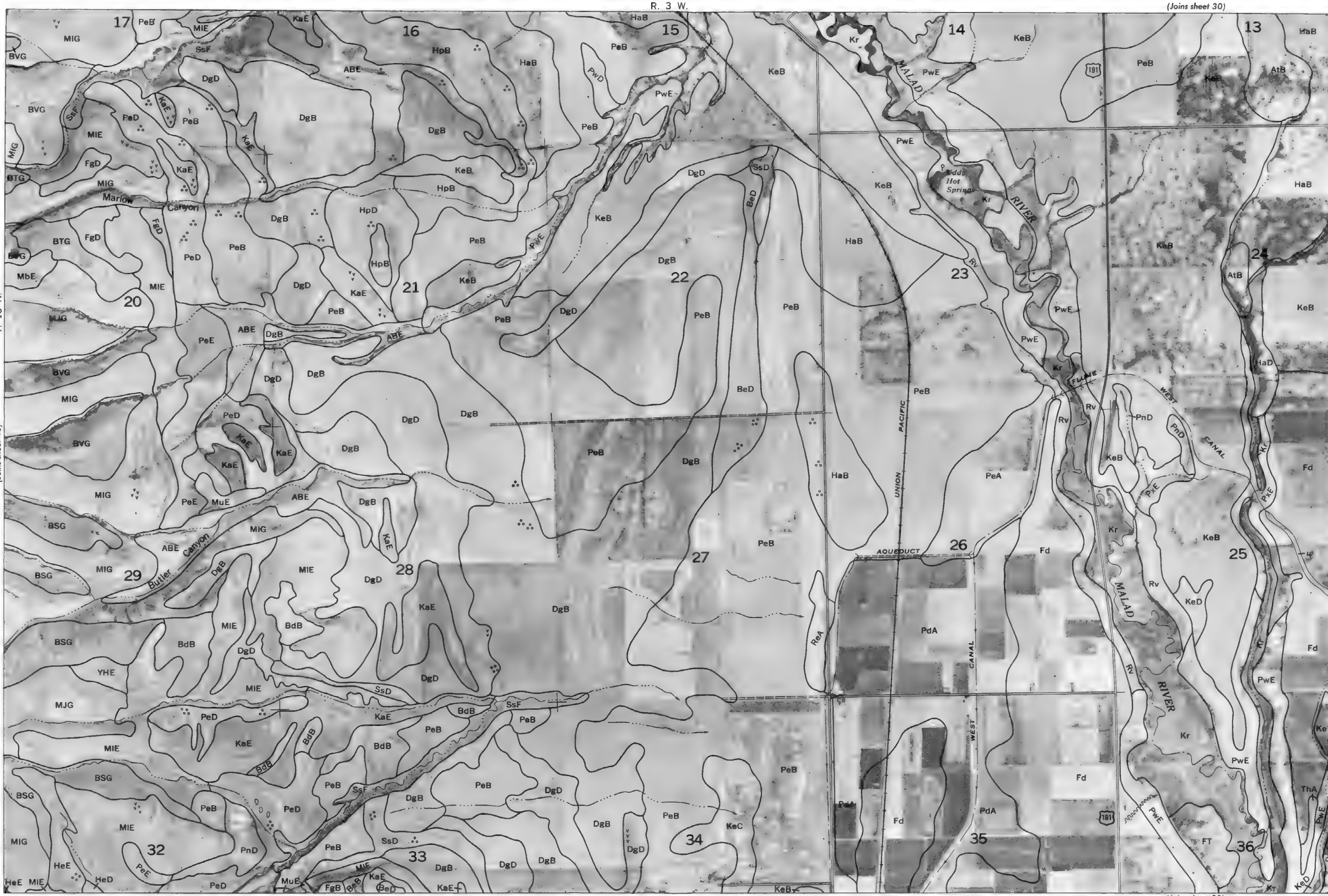
Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 41

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

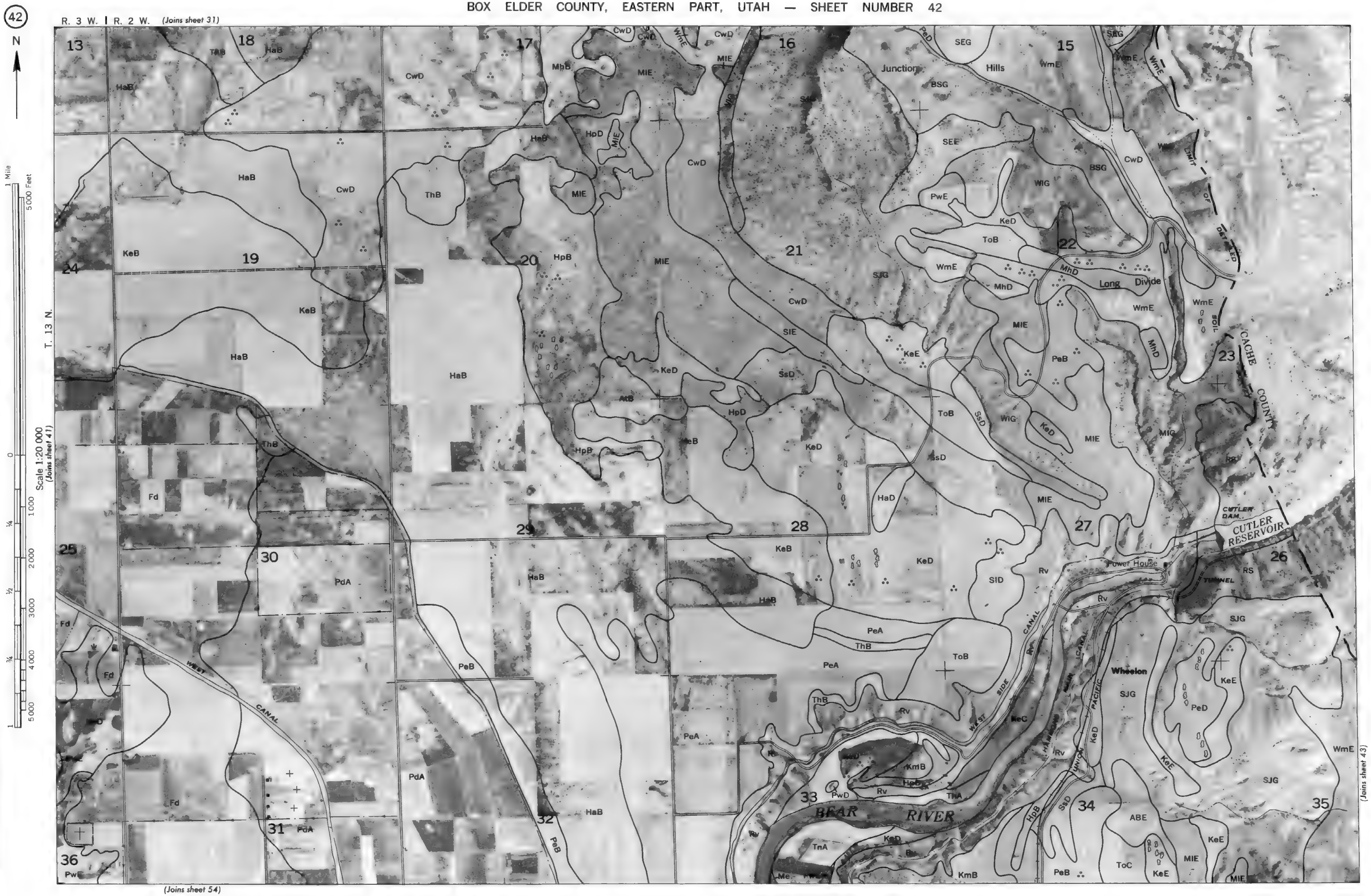


N

Scale 1:20 000

1 Mile ¾ ½ ¼ 0

5000 4000 3000 2000 1000 0 5000 Feet



Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of the Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

43

N

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 43

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

T. 13 N.

(Joins sheet 42)

(Joins sheet 55)

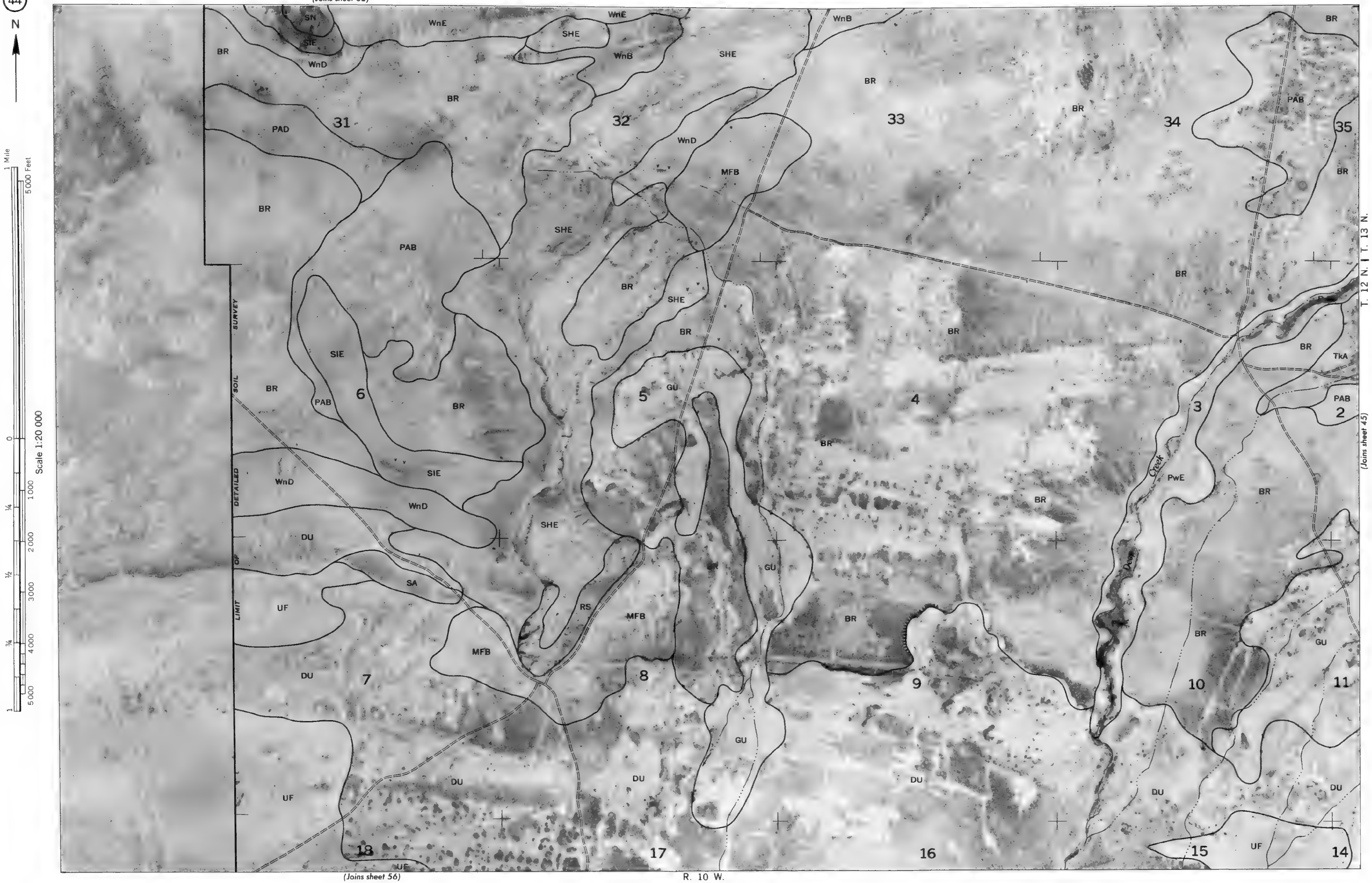
R. 2 W.

1 Mile

5000 Feet

Scale 1:20 000

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 44

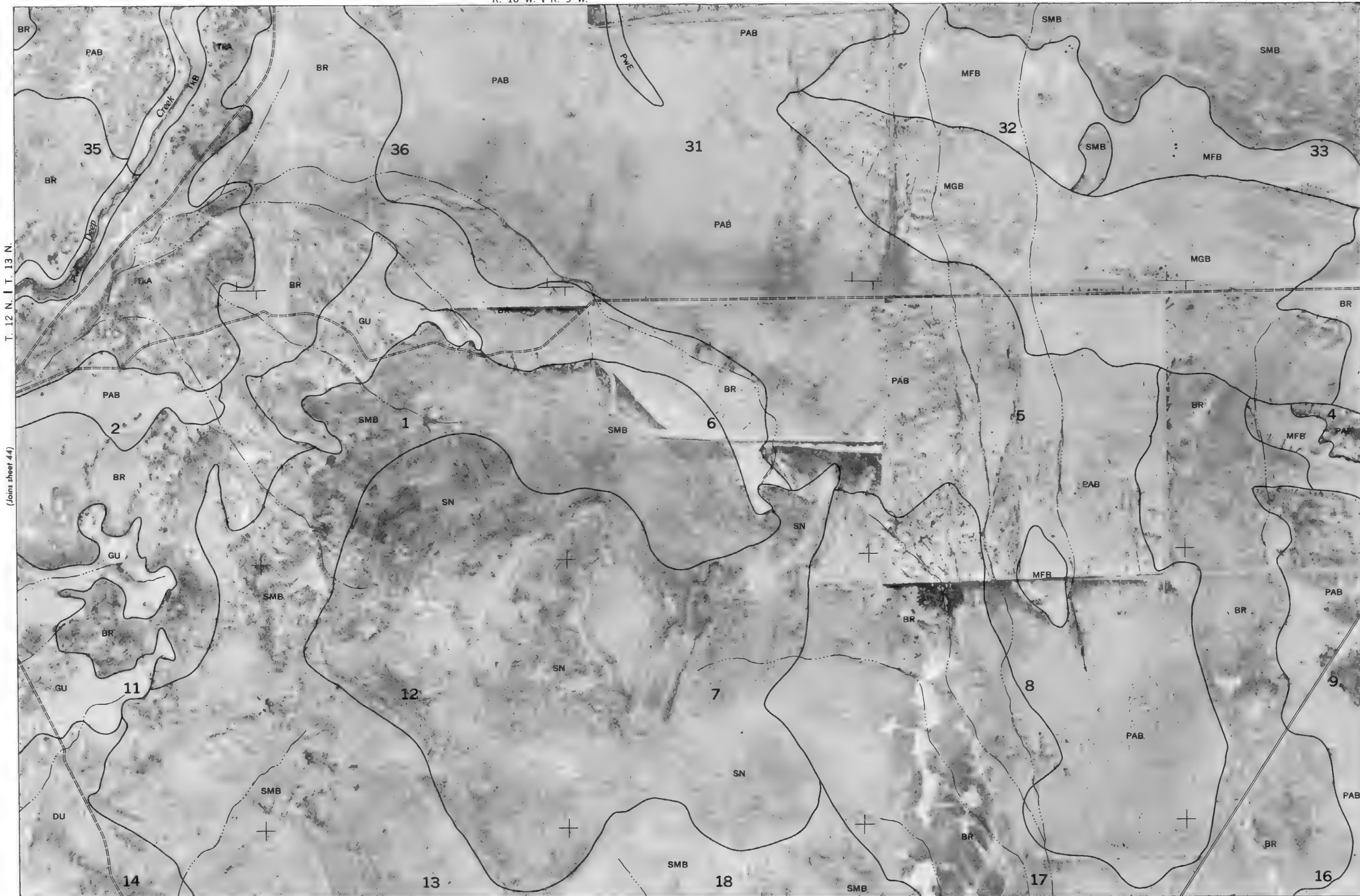


Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 45



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 45

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 46

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 47

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 48

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 49

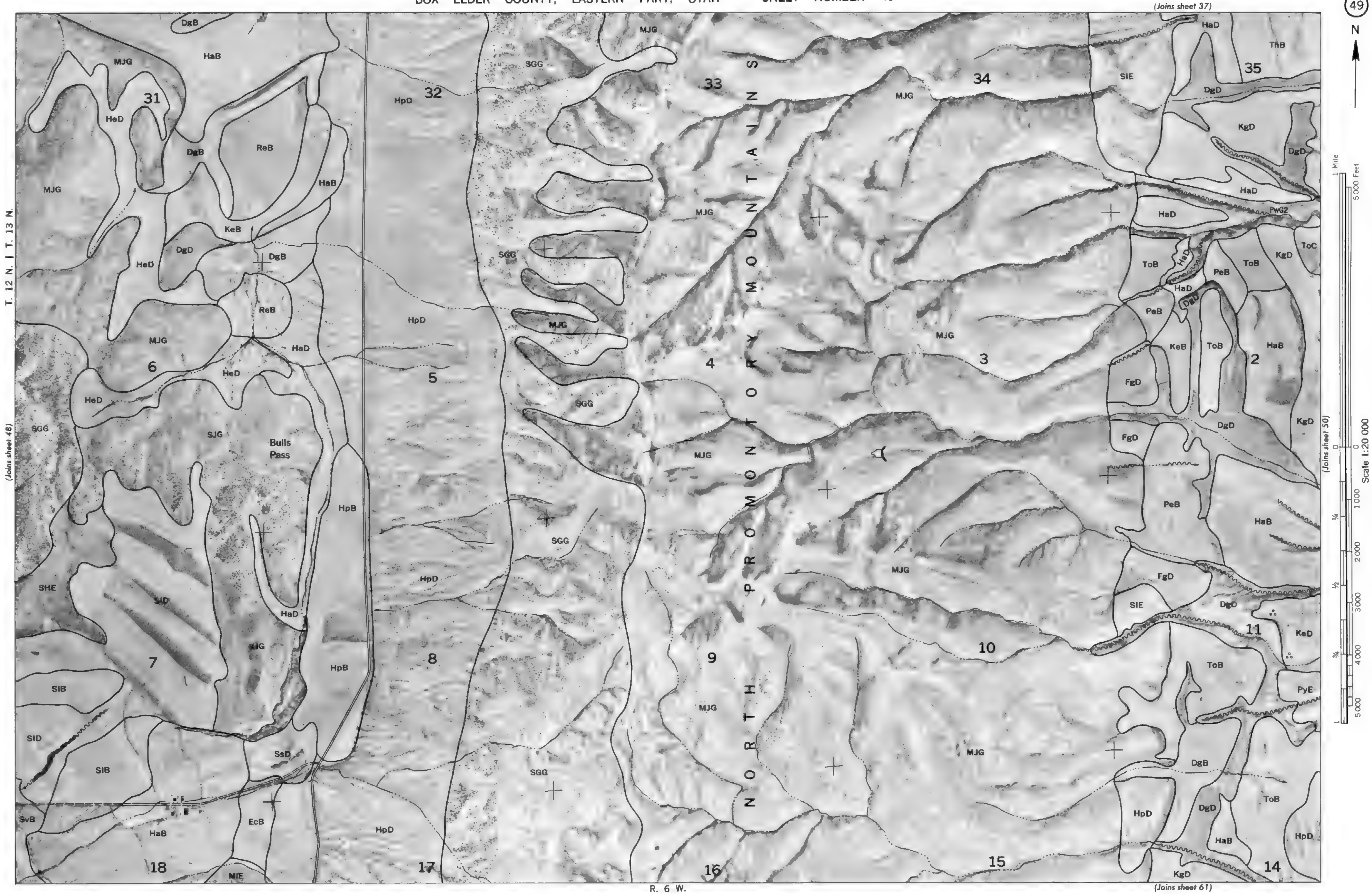
49

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 49

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.



BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 50

(Joins sheet 38)

R. 6 W. | R. 5 W.

N

1 Mile

5000 Feet

Scale 1:20 000

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

(Joins sheet 49)

(Joins sheet 51)

T. 12 N. | T. 13 N.

(Joins sheet 62)

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 50

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

(Joins sheet 40)

N

R. 4 W. | R. 3 W.

T. 13 N. | T. 12 N.

Scale 1:20 000

1 Mile

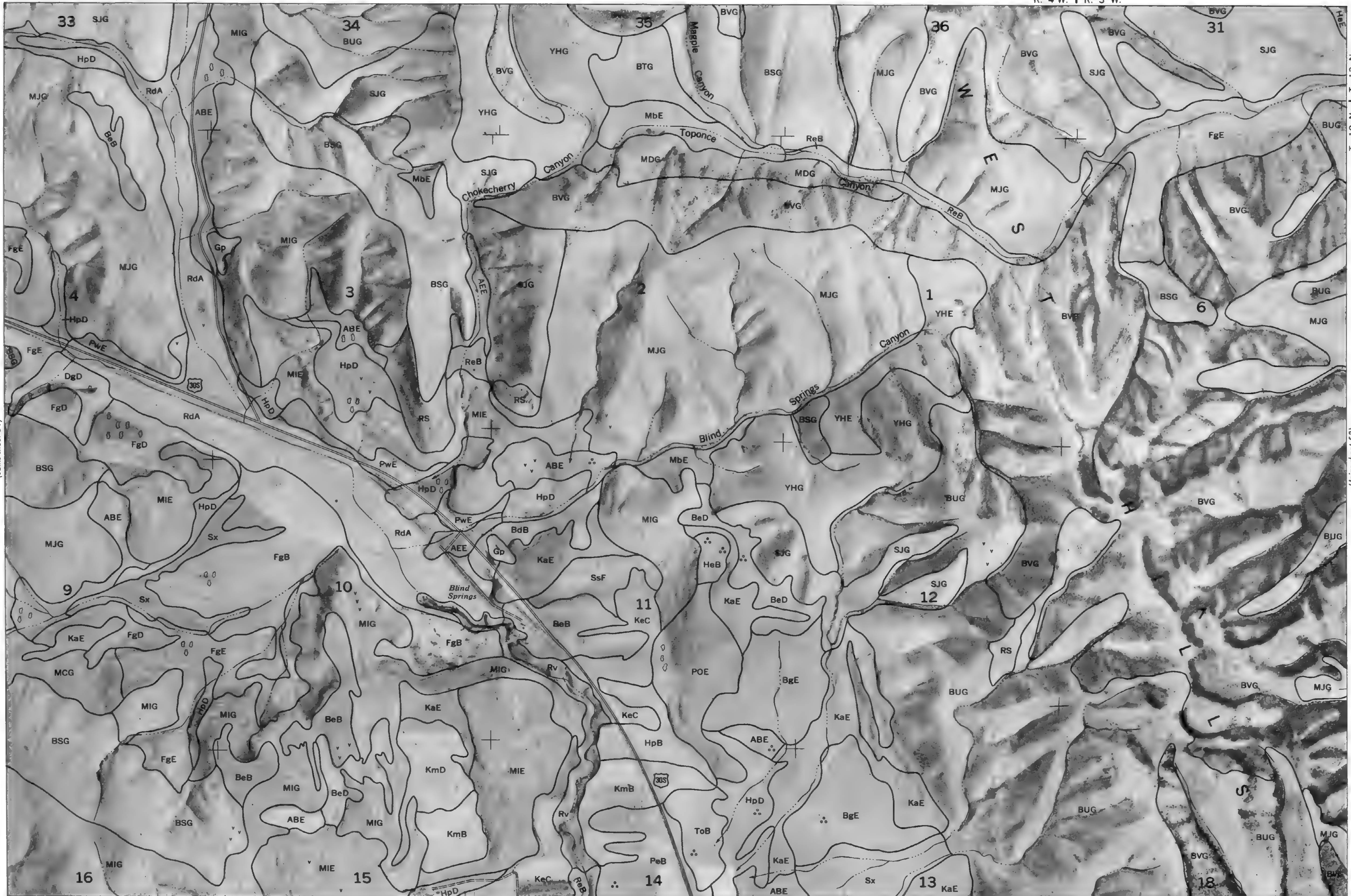
0 ¼ ½ ¾ 1

5000 Feet

0 1000 2000 3000 4000 5000

(Joins sheet 51)

(Joins sheet 53)

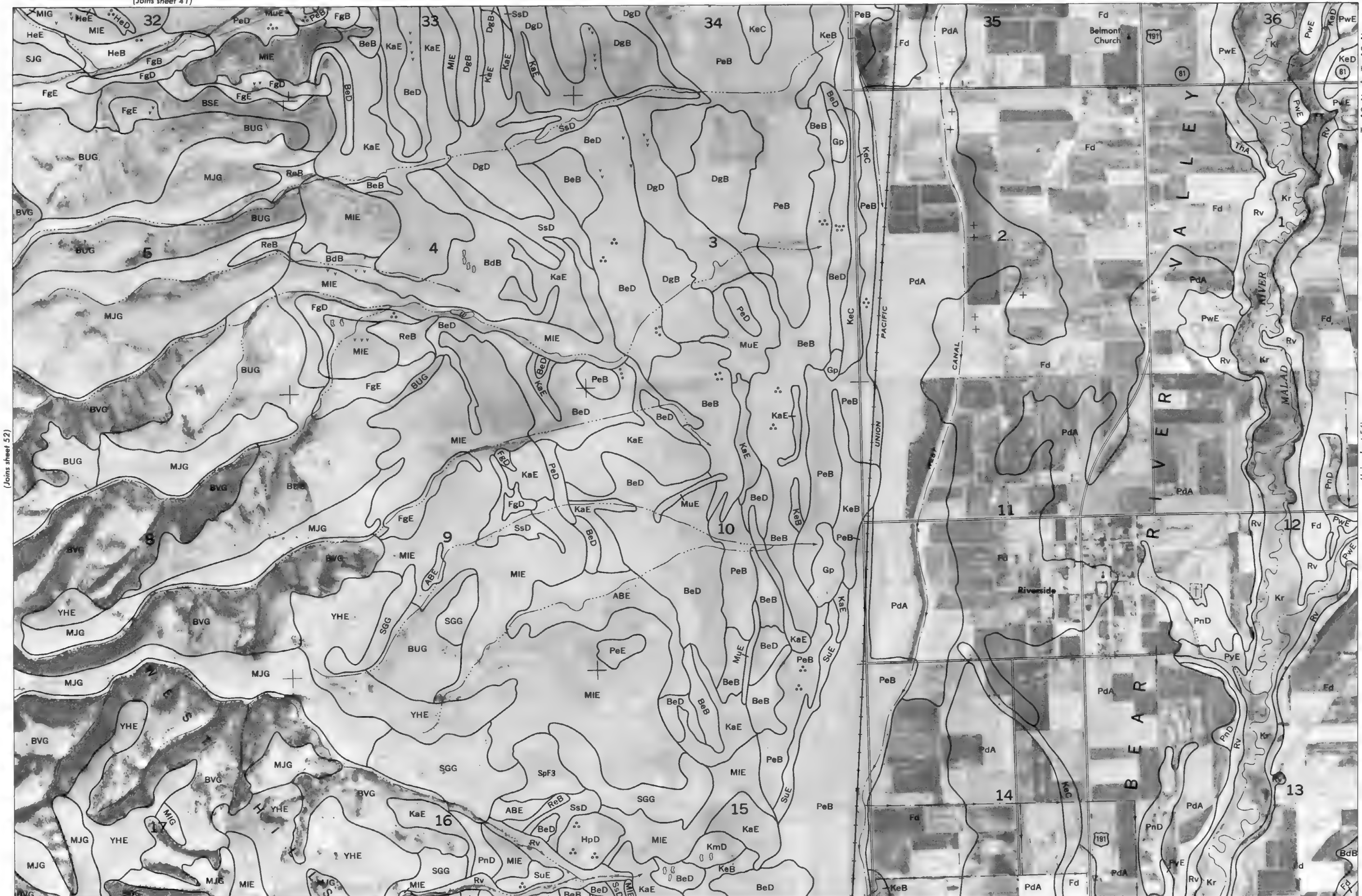


(Joins sheet 64)

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

53

(Joins sheet 41)



(Joins sheet 52)

(Joins sheet 54)

(Joins sheet 65)

R. 3 W.

T. 13 N.

T. 12 N.

N

1 Mile

5000 Feet

Scale 1:20 000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 53

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

54

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 54

R. 3 W. | R. 2 W. (Joins sheet 42)

N

1 Mile

5000 Feet

Scale 1:20 000

0 — 1000 — 2000 — 3000 — 4000 — 5000

0 — ¼ — ½ — ¾ — 1

(Joins sheet 53)

(Joins sheet 66)

(Joins sheet 55)

T. 13 N. | T. 12 N.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 54

55

N

R. 2 W. (Joins sheet 43)

T. 13 N. | T. 12 N.

(Joins sheet 67)

1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 55

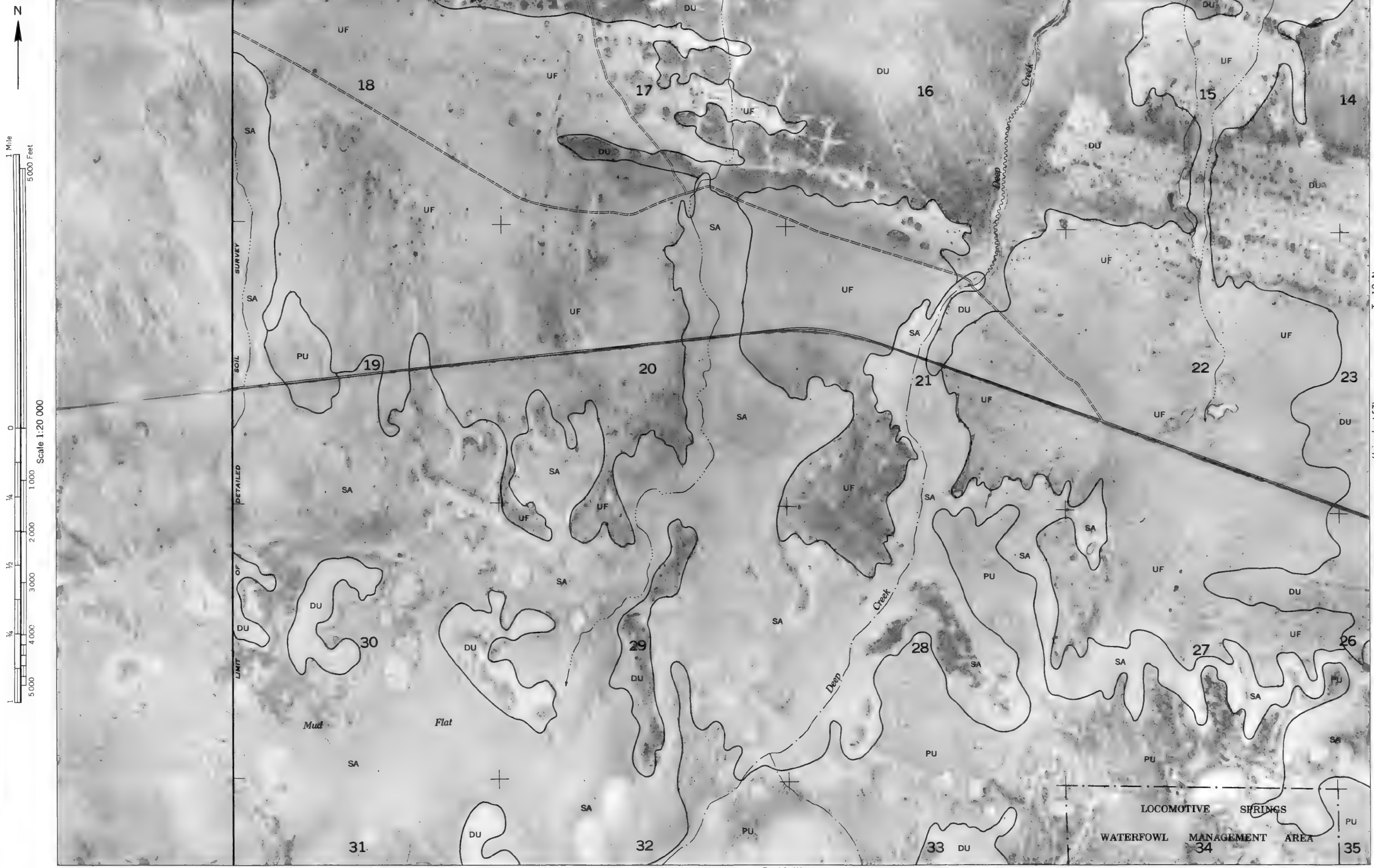
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 56

(Joins sheet 44)



(Joins sheet 68)

R. 10 W.

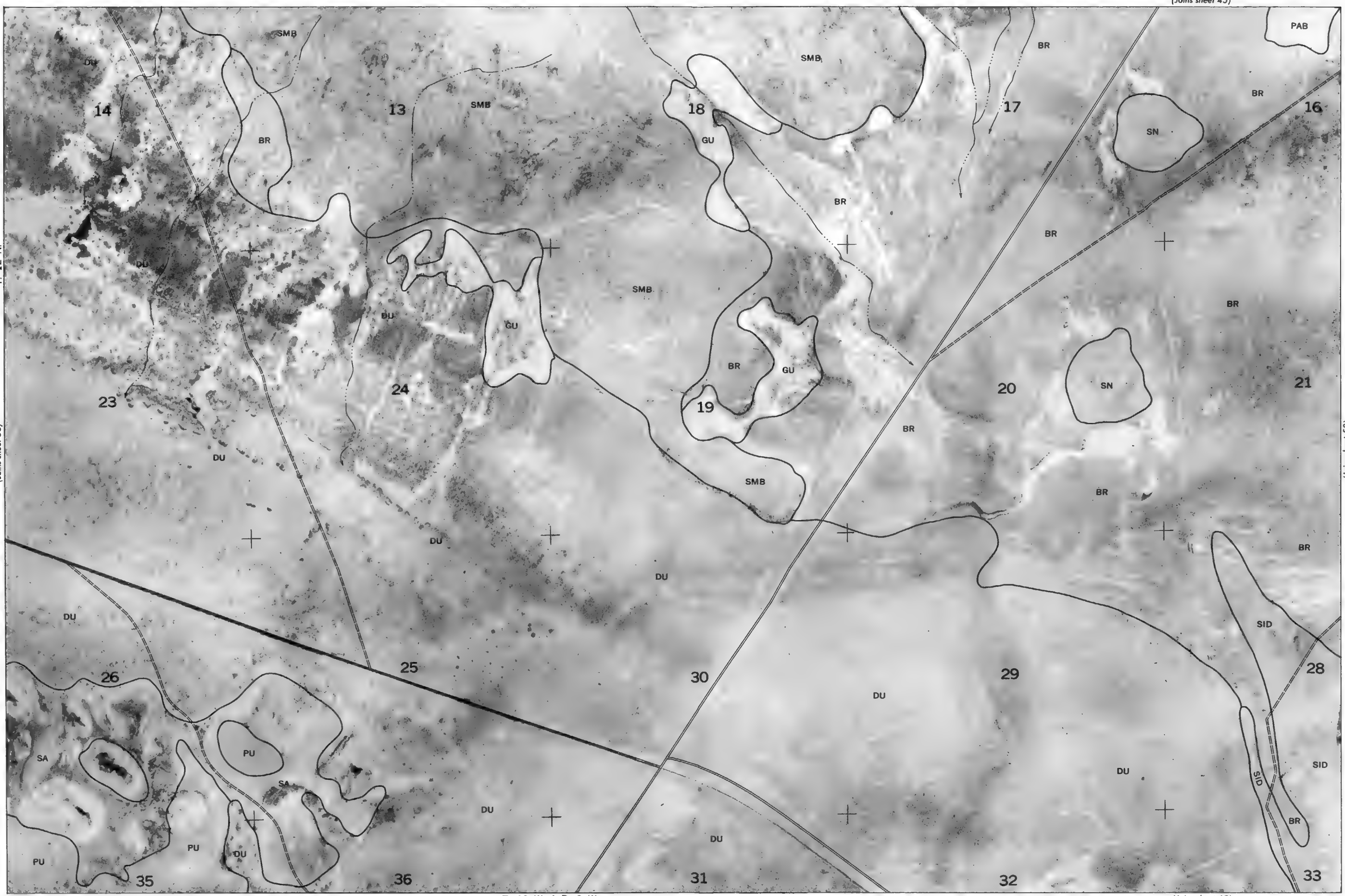
(Joins sheet 57)

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 45)



T. 12 N.

(Joins sheet 56)

(Joins sheet 58)

R. 10 W. | R. 9 W.

(Joins sheet 69)

57

N

Scale 1:20 000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 57

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 58

N

Scale 1:20 000

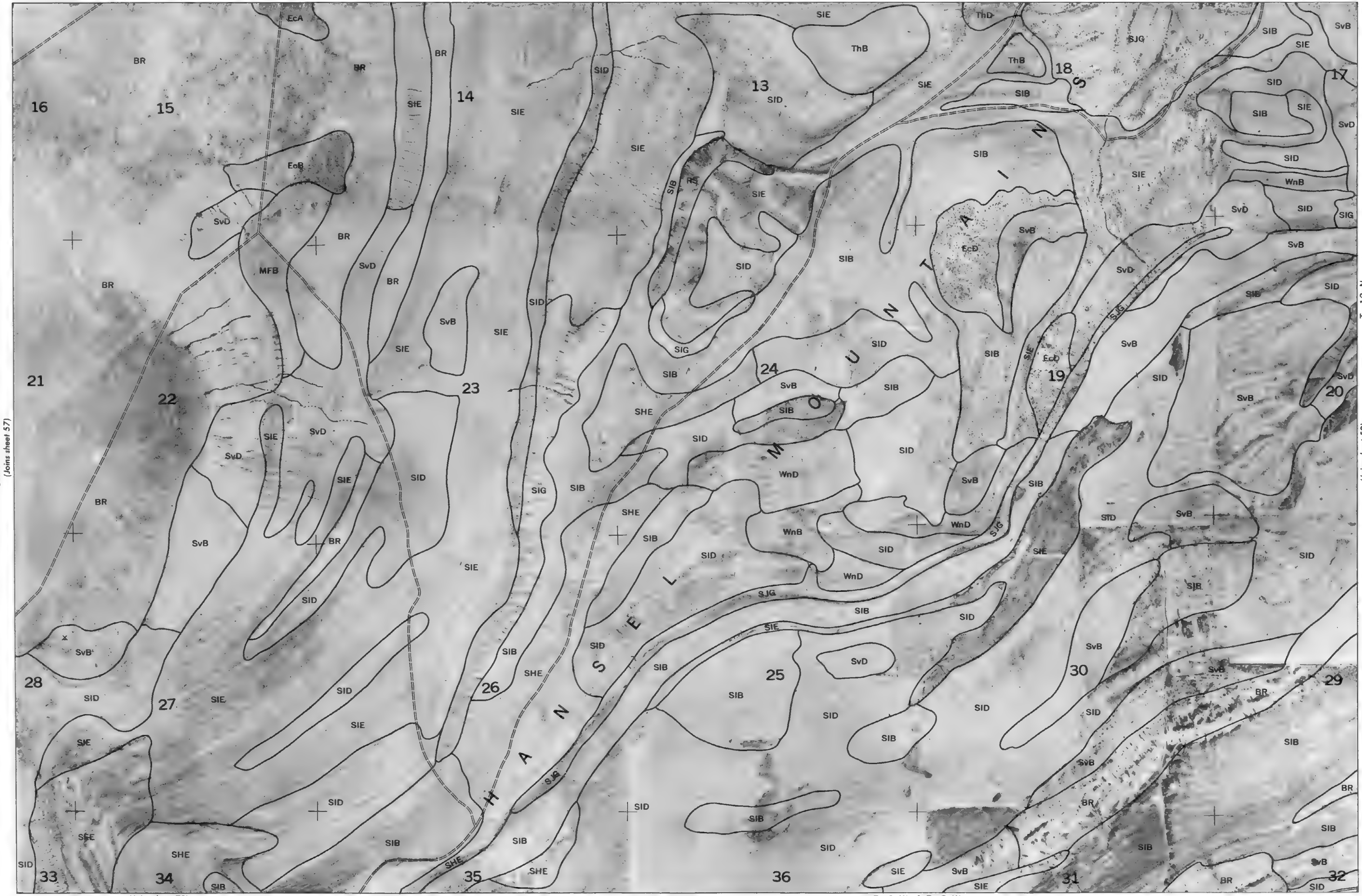
1 Mile 5 000 Feet

0 1 000 2 000 3 000 4 000 5 000

0 ¼ ½ ¾ 1

(Joins sheet 46)

(Joins sheet 57)



(Joins sheet 59)

(Joins sheet 70)

T. 12 N.

R. 9 W. | R. 8 W.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 58

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 59

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 60

R. 7 W. | R. 6 W.

N

(Joins sheet 48)

(Joins sheet 72)

(Joins sheet 59)

(Joins sheet 61)

Scale 1:20 000

1 Mile

5000 Feet

0 | 1000 | 2000 | 3000 | 4000 | 5000

0 | ¼ | ½ | ¾ | 1

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management; and the Utah Agricultural Experiment Station.

(61)

(Joins sheet 49)

(Joins sheet 60)

T. 12 N.

(Joins sheet 62)

R. 6 W.

(Joins sheet 73)

N

Scale 1:20 000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 61

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 62

(Joins sheet 50)

(Joins sheet 74)

Land division corners are approximately positioned on this map

Photobase from 1959 aerial photography

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 62

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 63

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 63

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

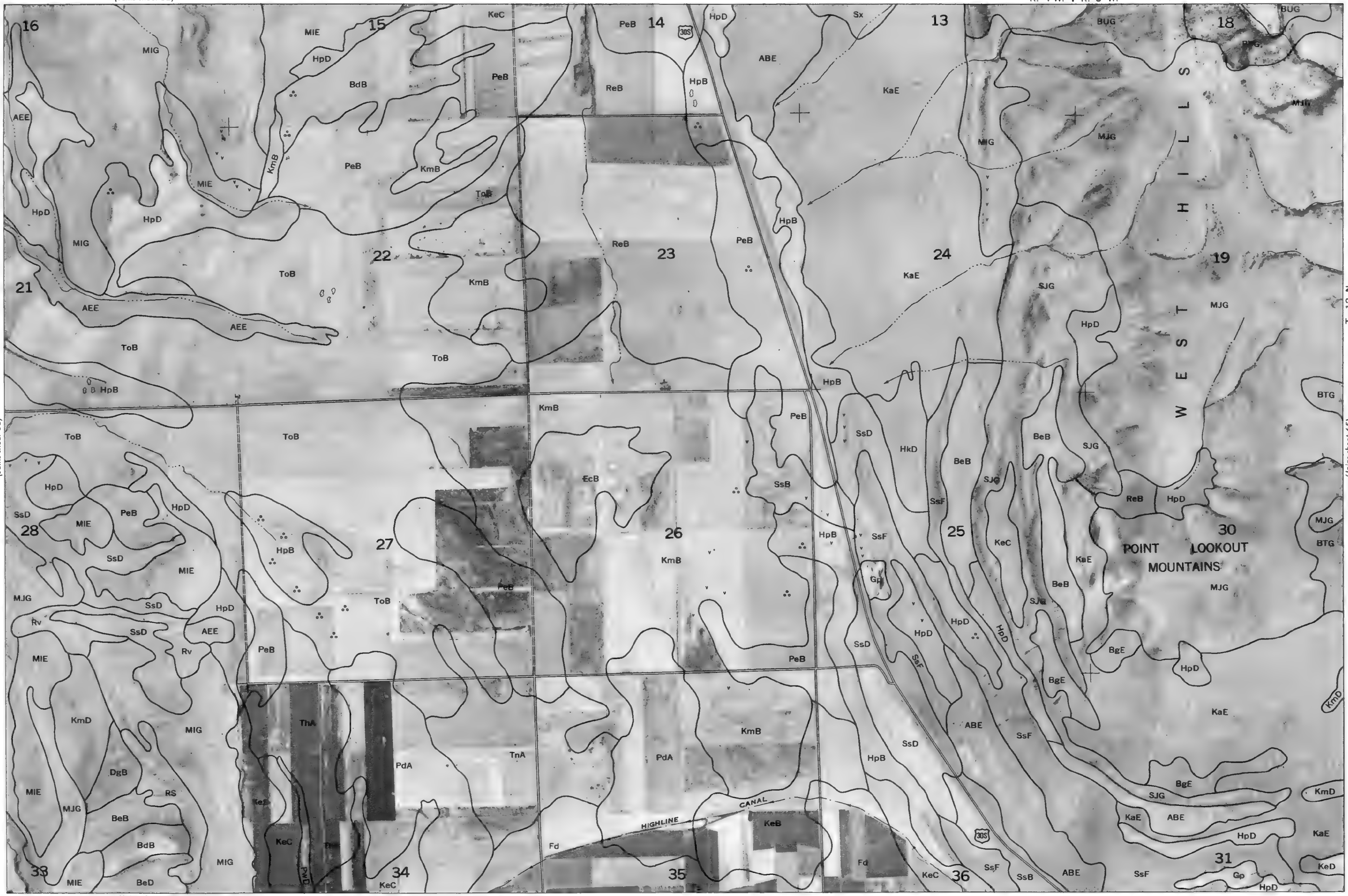
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

(Joins sheet 52)

R. 4 W. | R. 3 W.

N



Scale 1:20 000

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

(Joins sheet 63)

(Joins sheet 65)

(Joins sheet 76)

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 53)

65

N

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 65

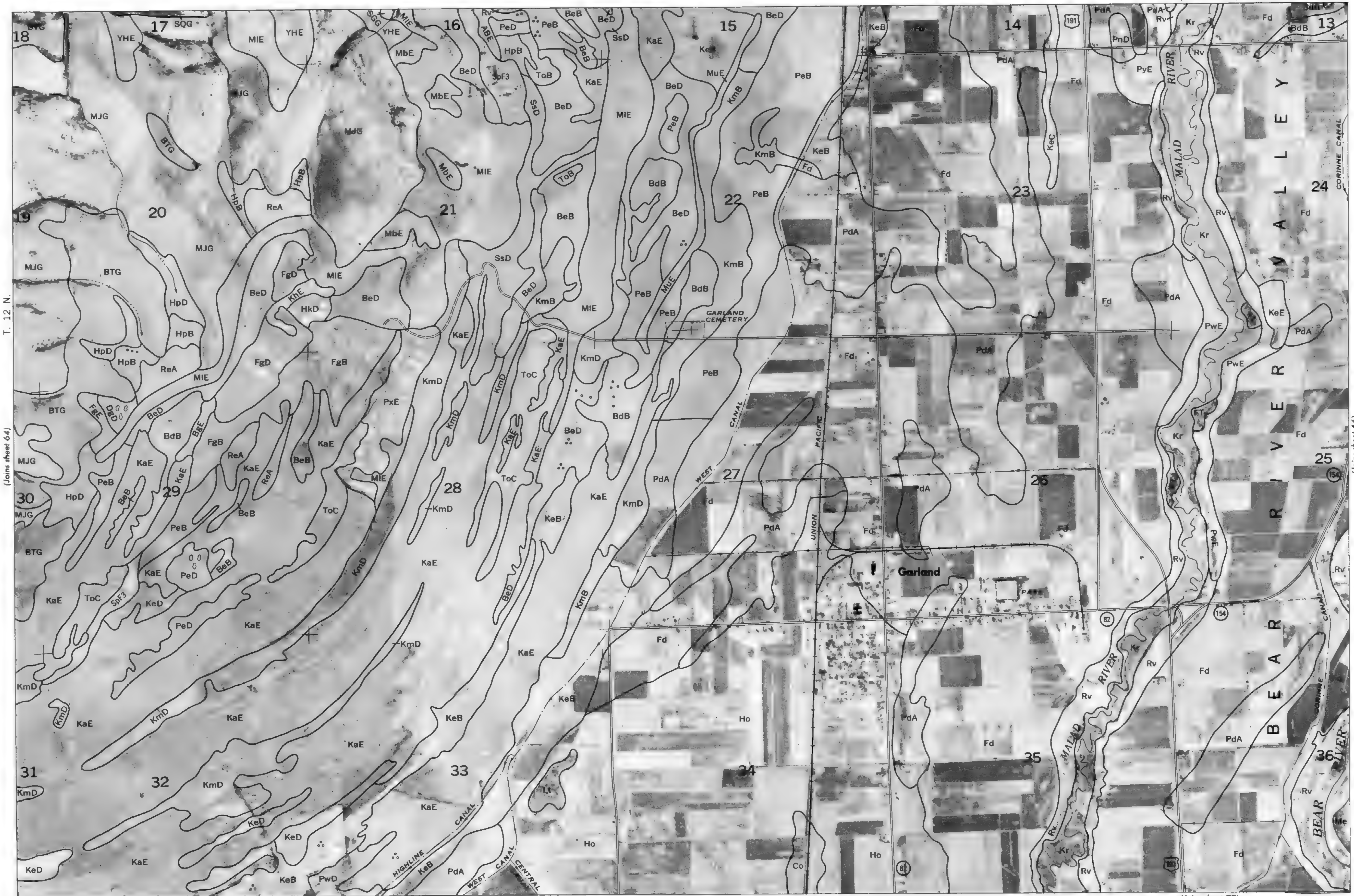
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

T. 12 N.

(Joins sheet 64)



(Joins sheet 66)

Scale 1:20 000

1 Mile

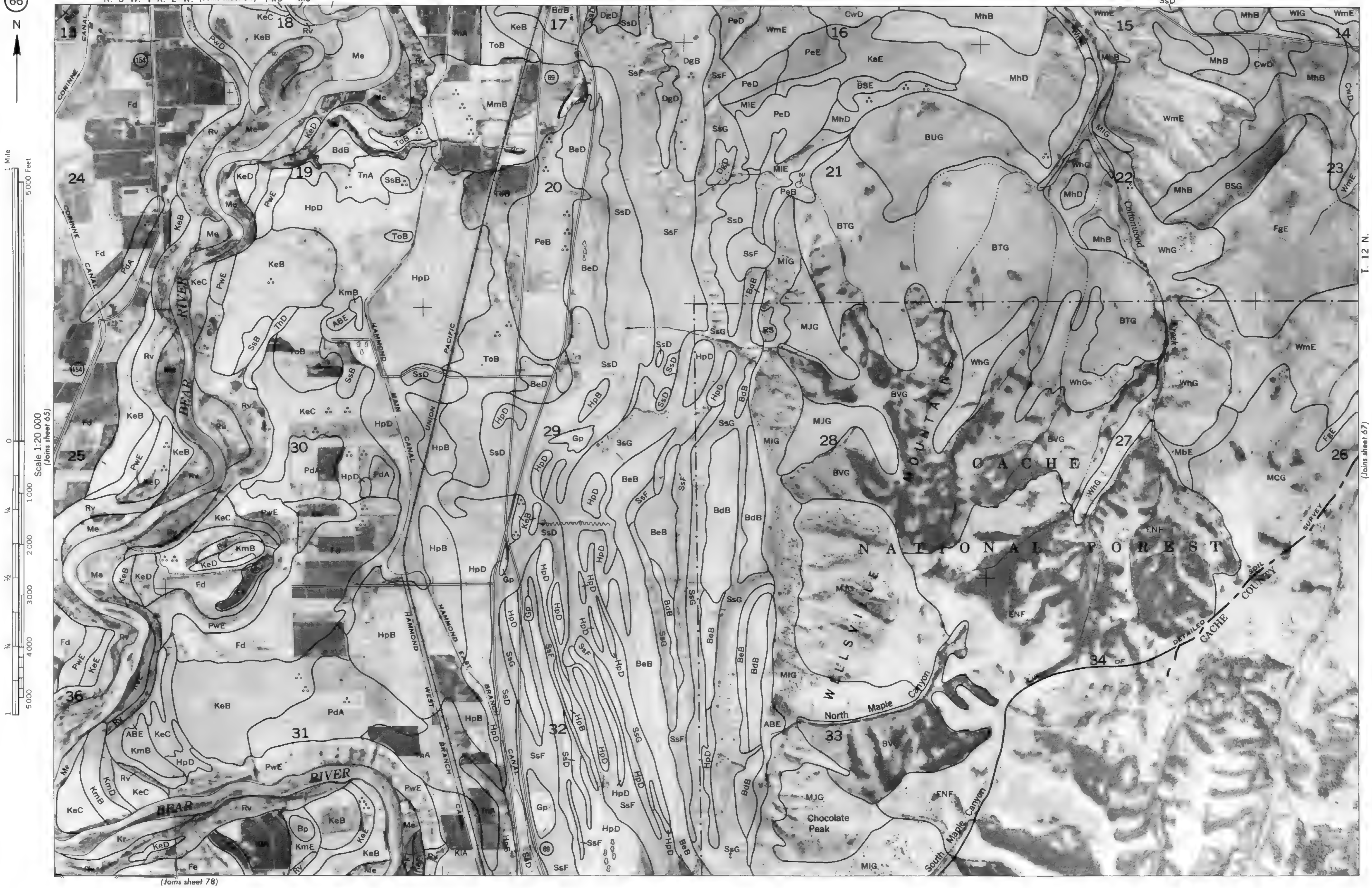
5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

R. 3 W.

(Joins sheet 77)



Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of the Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 67

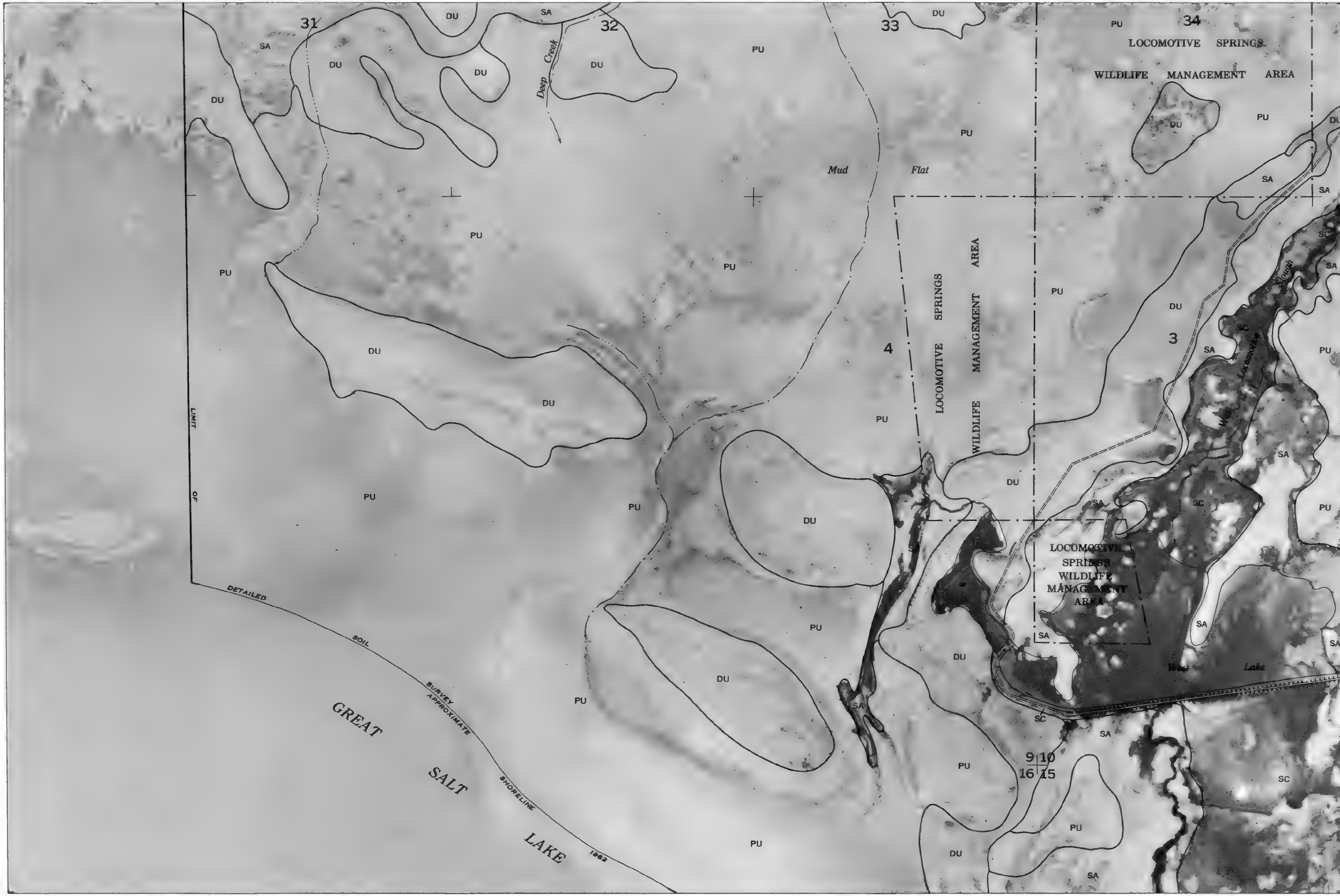
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 68

(Joins sheet 56)



N

Scale 1:20 000

1 Mile

5000 Feet

(Joins sheet 79)

R. 10 W.

T. 12 N. | T. 11 N.

(Joins sheet 69)

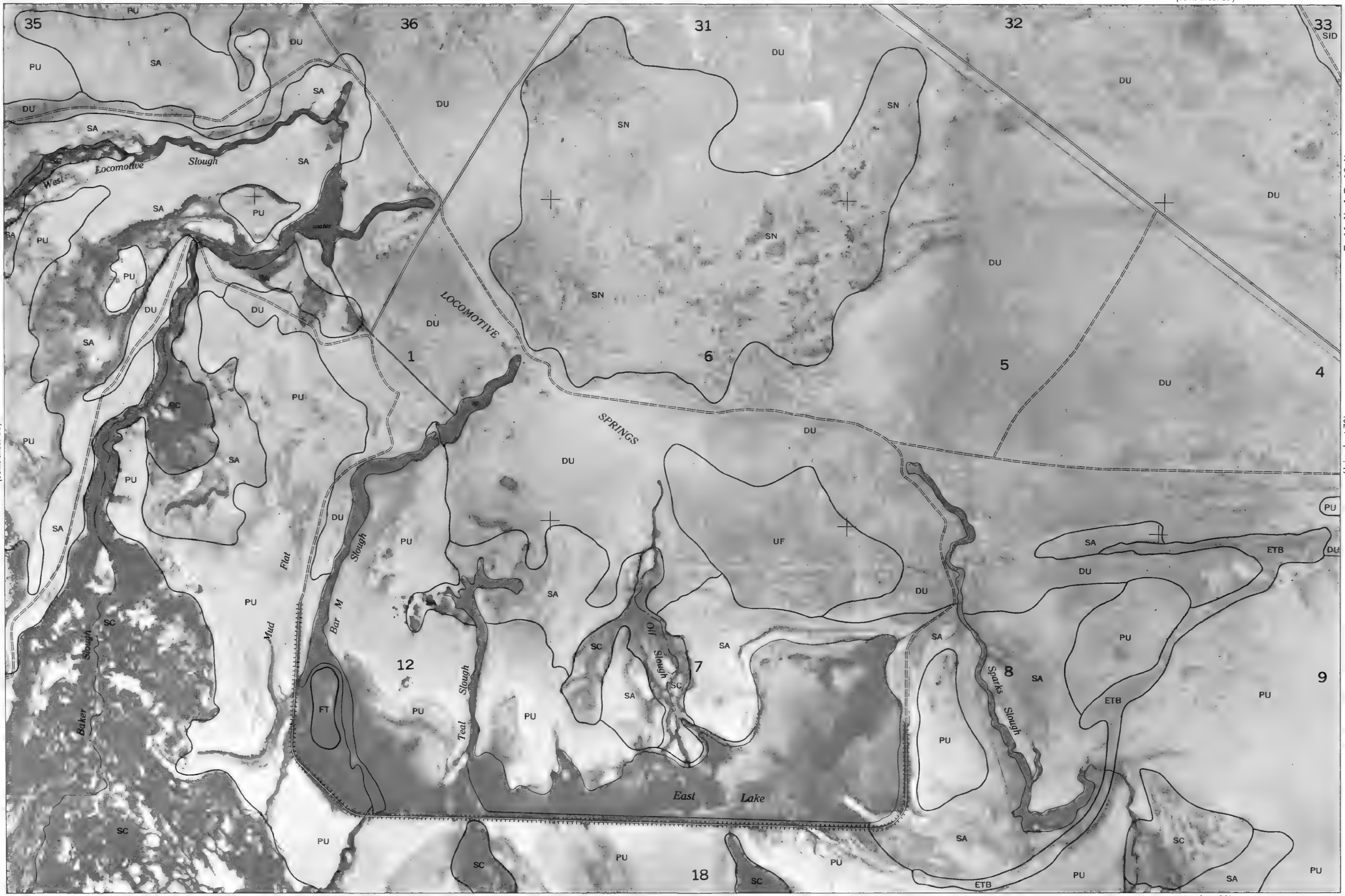
Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(69)

(Joins sheet 57)



(Joins sheet 68)

(Joins sheet 70)

(Joins sheet 80)

R. 10 W. | R. 9 W.

T. 11 N. | T. 12 N.

N

Scale 1:20 000

1 Mile
0 ¼ ½ ¾ 1
5000 Feet
0 1000 2000 3000 4000 5000

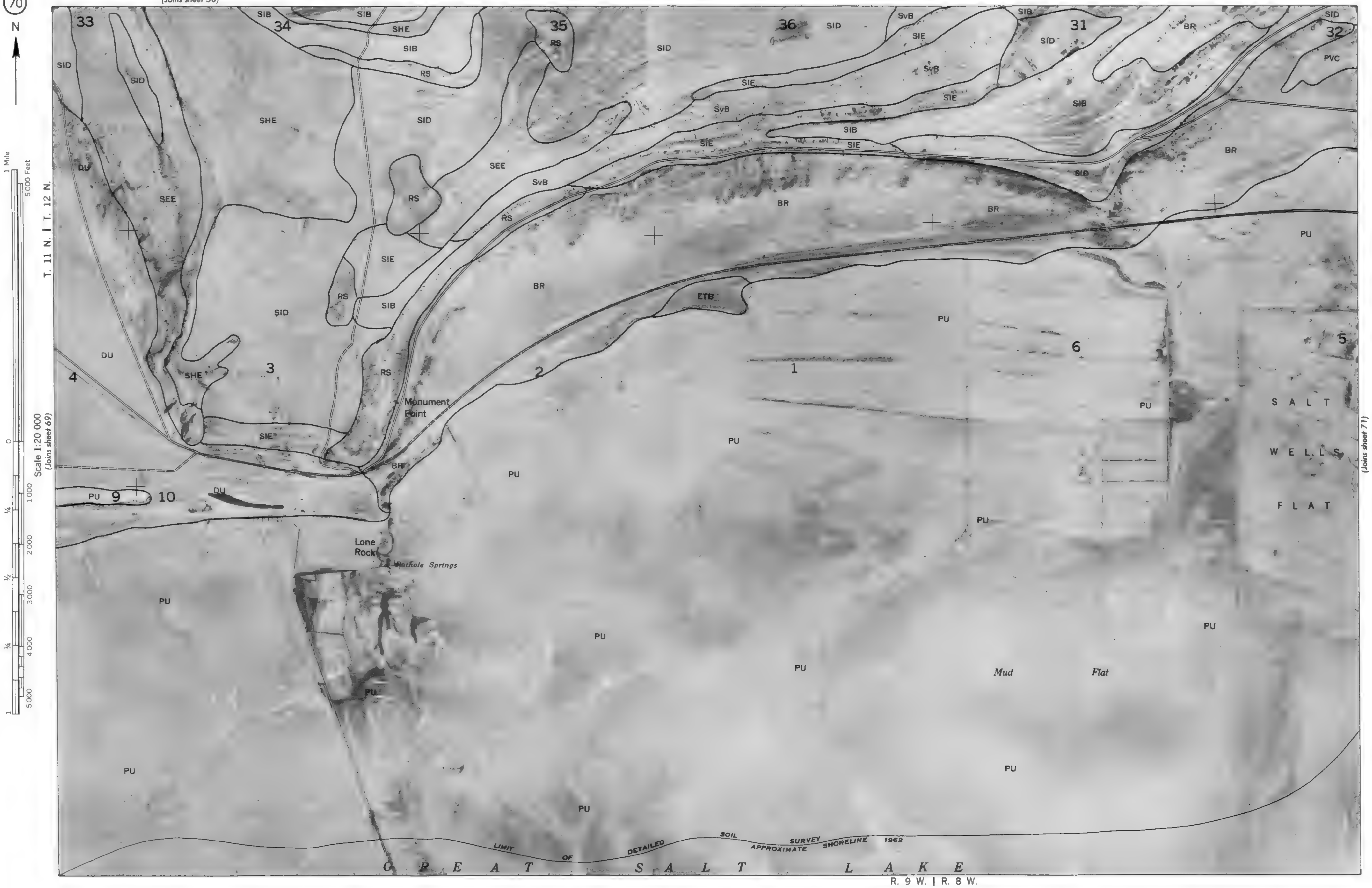
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 69

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 70



Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

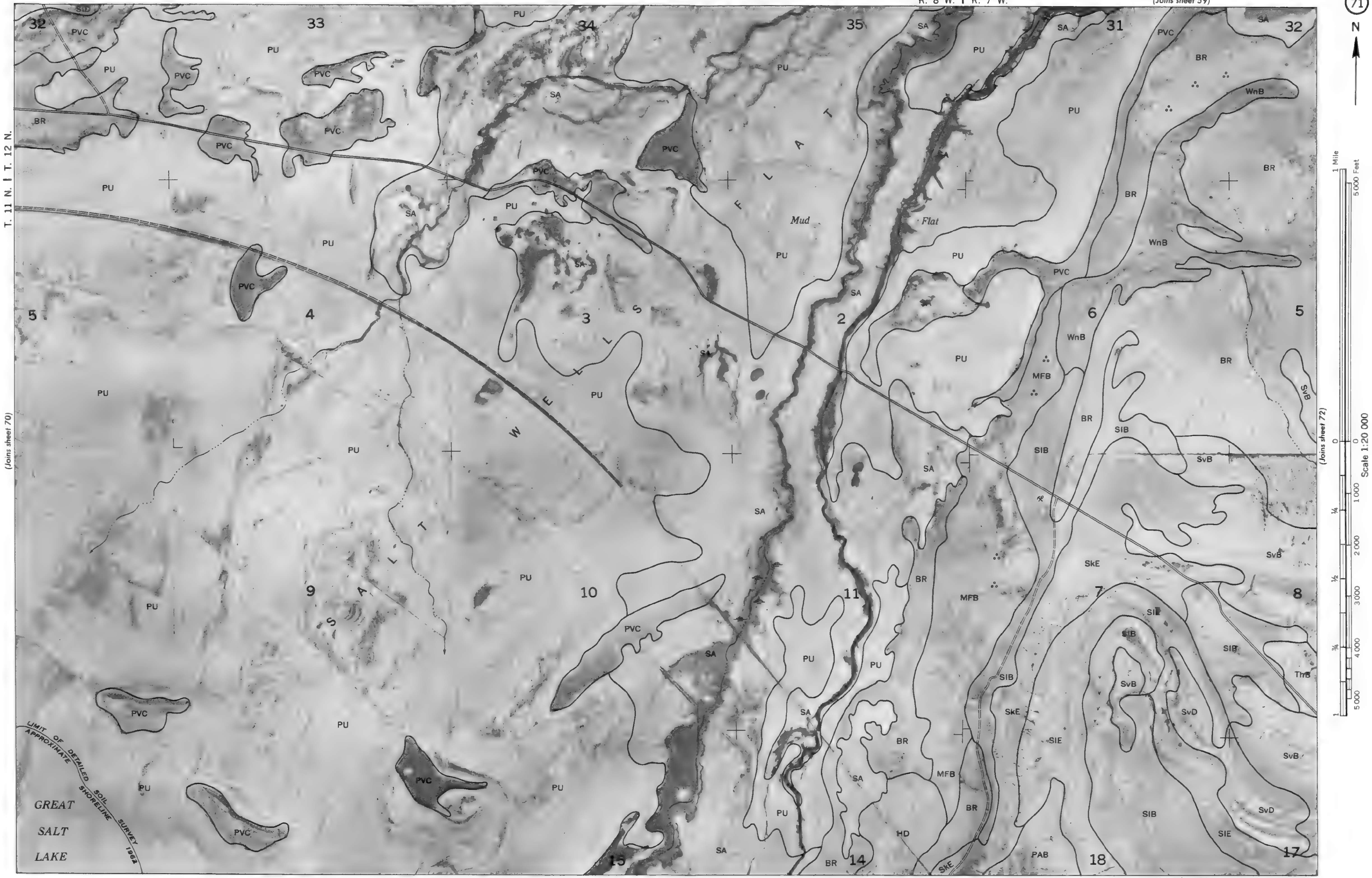
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 70

R. 8 W. | R. 7 W.

(Joins sheet 59)

71



(Joins sheet 81)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 71

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 72

(Joins sheet 60)

(Joins sheet 71)

(Joins sheet 73)

(Joins sheet 82)

R. 7 W.

N

Scale 1:20 000

1 Mile

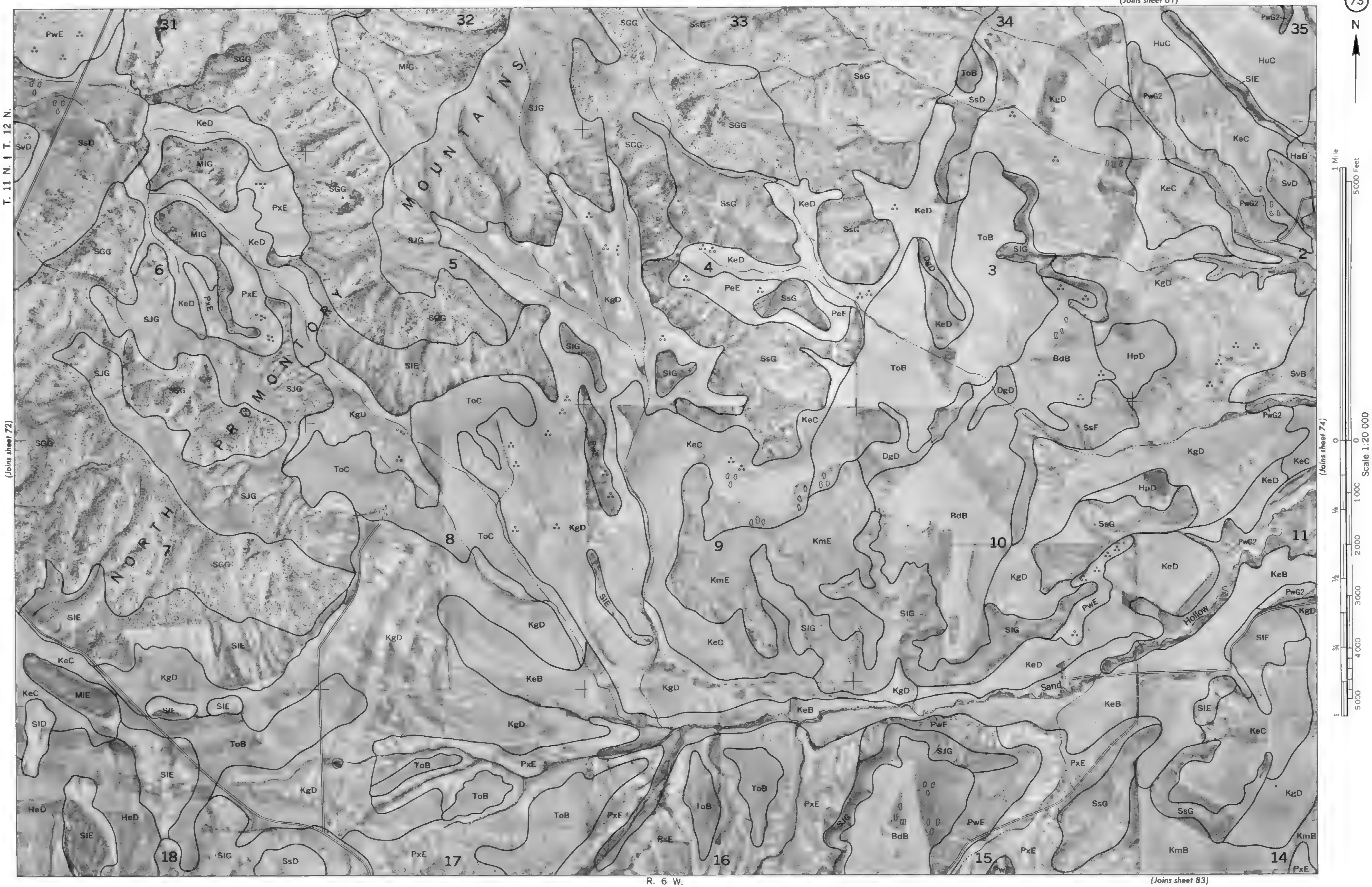
5000 Feet

0 1000 2000 3000 4000 5000

¼ ½ ¾ 1

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 73



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 73

74

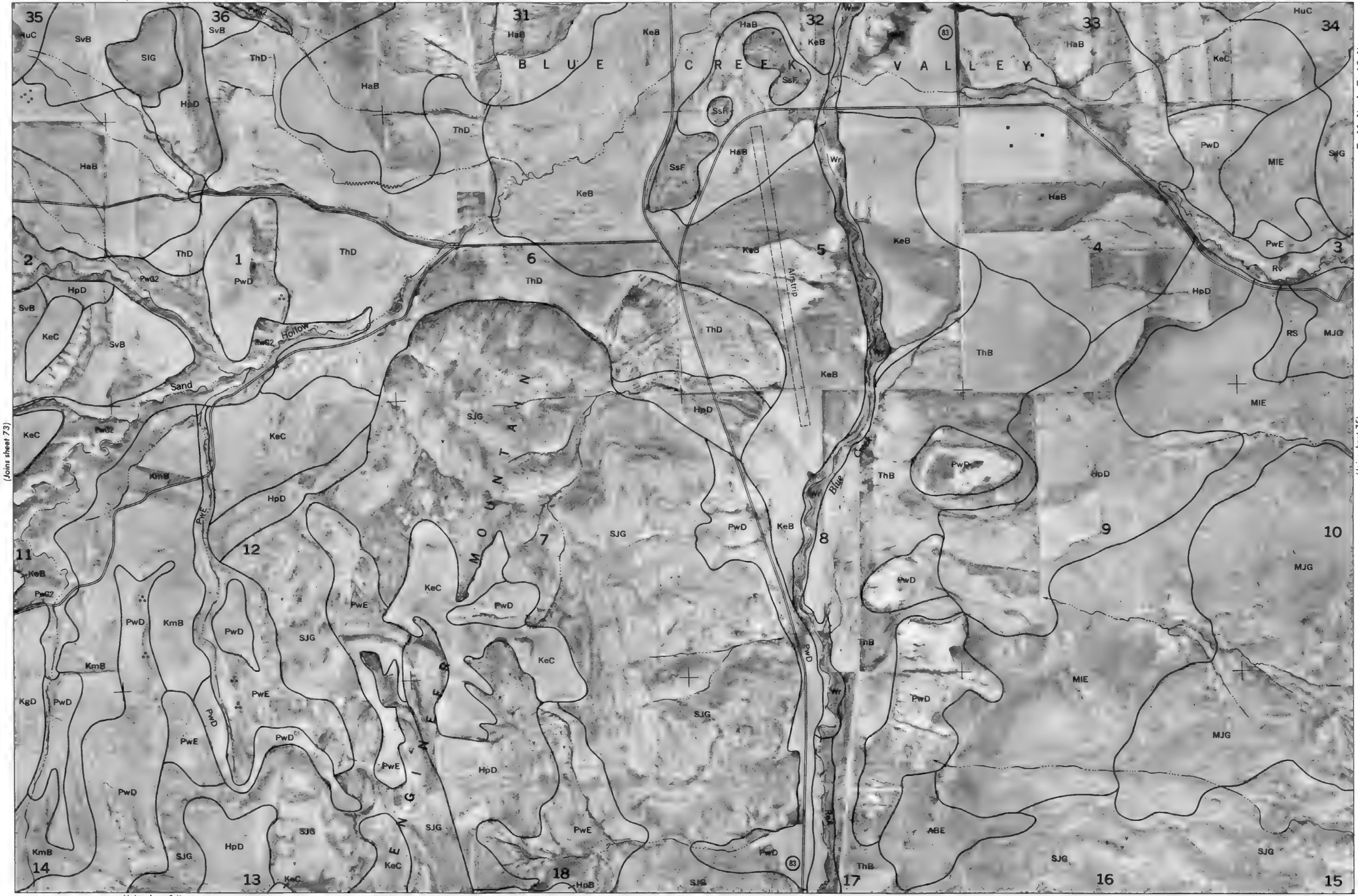
BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 74

N

(Joins sheet 62)

1 Mile
5000 Feet
Scale 1:20 000
0 1/4 1/2 3/4 1
0 1000 2000 3000 4000 5000

(Joins sheet 73)



(Joins sheet 75)

T. 12 N.
T. 11 N.

(Joins sheet 84)

R. 6 W. | R. 5 W.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 75

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 76

N

(Joins sheet 64)

R. 4 W. | R. 3 W.

T. 12 N. | T. 11 N.

(Joins sheet 75)

(Joins sheet 77)

(Joins sheet 86)

Scale 1:20 000

1 Mile

5 000 Feet

0 | 1 000 | 2 000 | 3 000 | 4 000 | 5 000

0 | ¼ | ½ | ¾ | 1

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 77

77

(Joins sheet 65)

N

Scale 1:20 000

1 Mile

5000 Feet

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 77

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 78

R. 3 W. | R. 2 W. (Joins sheet 66)

N

Scale 1:20 000 (Joins sheet 77)

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

T. 11 N.

(Joins sheet 88)

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 79

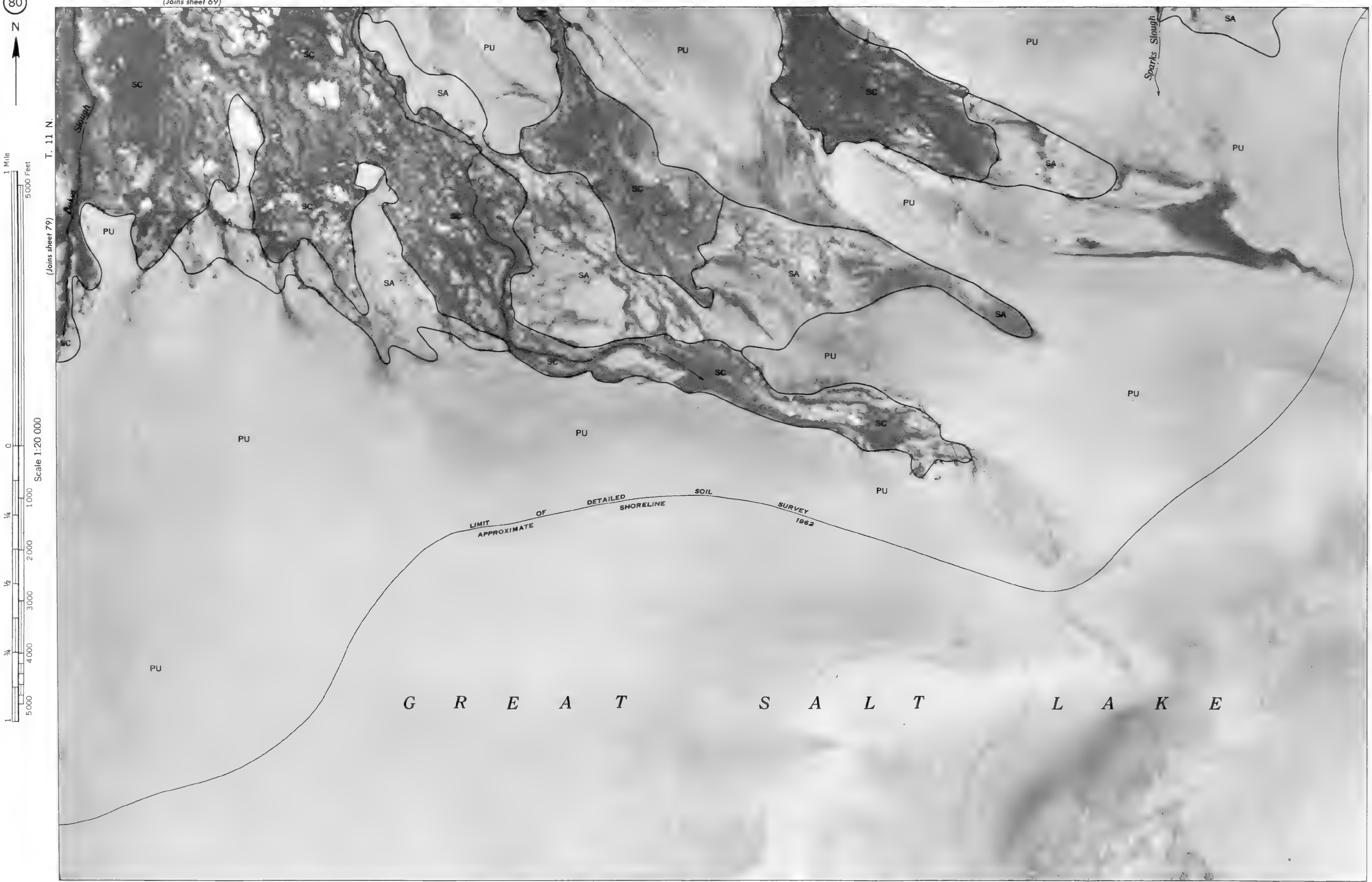
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 79

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 80



R. 10 W. | R. 9 W.

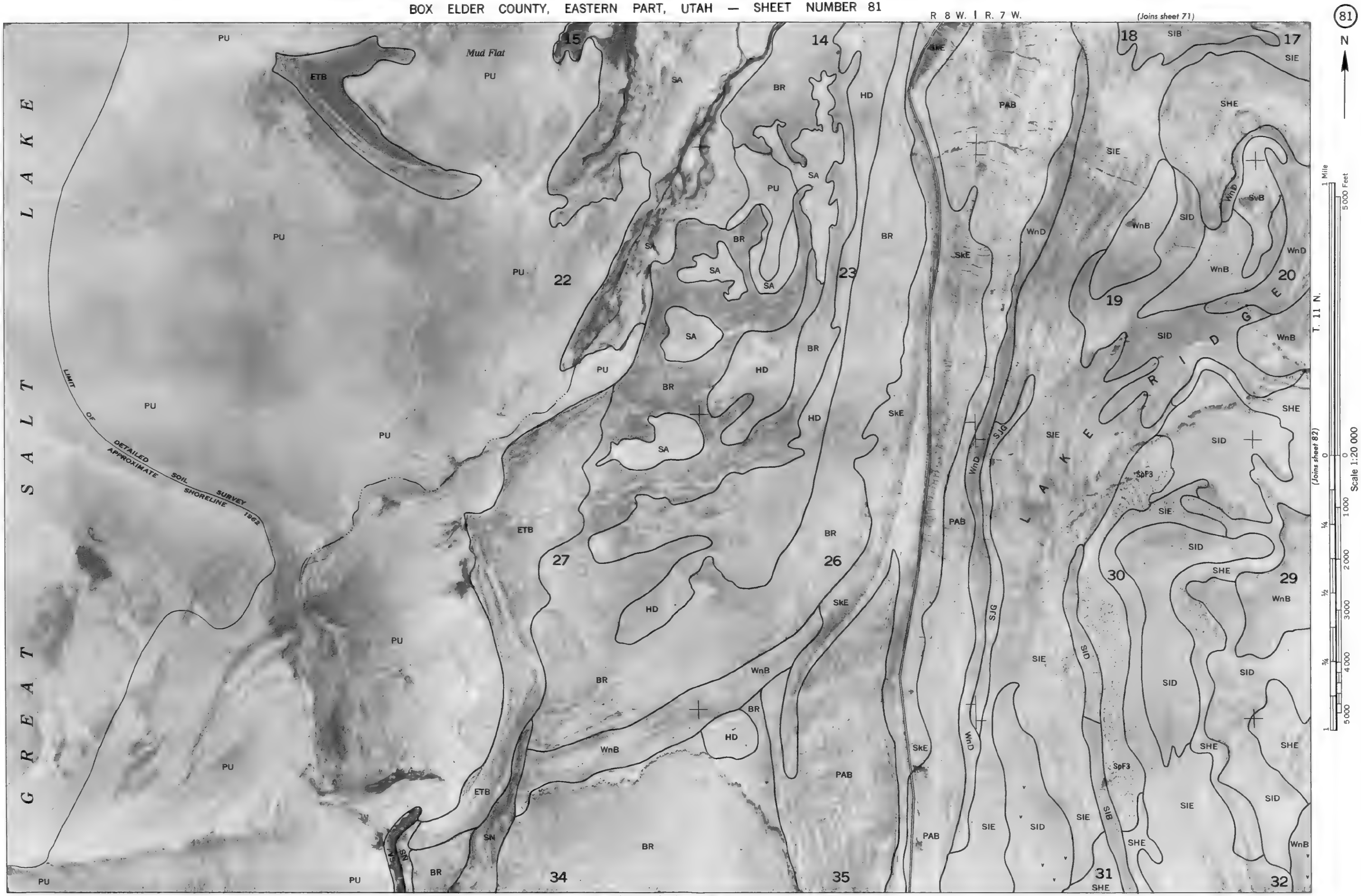
Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management; and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 80

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 81



(Joins sheet 89) | (Joins sheet 90)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 81

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 82

(Joins sheet 72)

(Joins sheet 90) | (Joins sheet 91)

R. 7 W.

T. 11 N.

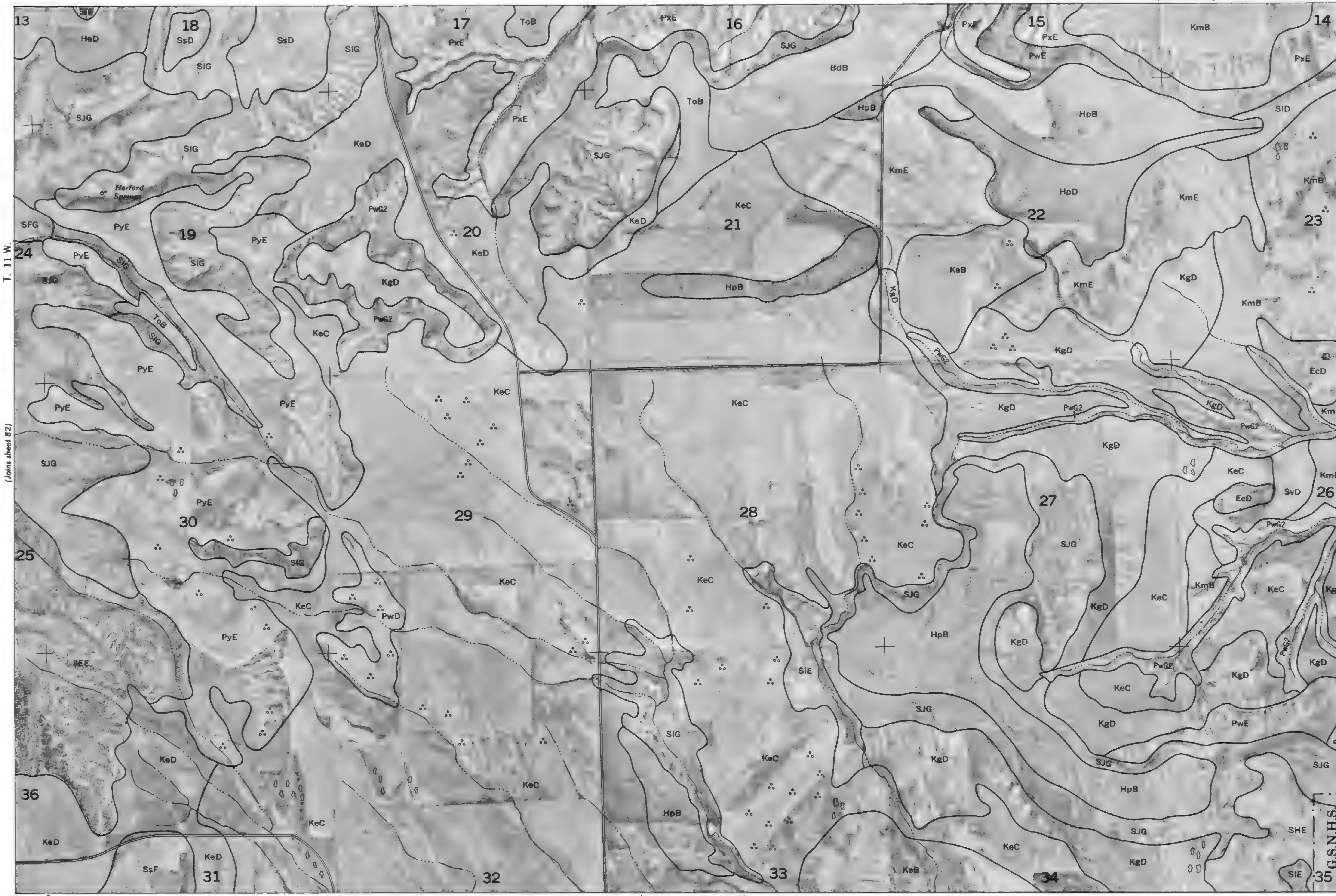
Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 73)

83



N

Scale 1:20 000

1 Mile

0 ¼ ½ ¾ 1

5000 Feet

0 1000 2000 3000 4000 5000

(Joins sheet 84)

(Joins sheet 82)

T. 11 W.

R. 7 W. | R. 6 W.

(Joins sheet 91) | (Joins sheet 92)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 83

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

84

N

(Joins sheet 74)

Scale 1:20 000

1 Mile

5 000 Feet

(Joins sheet 83)

T. 11 N.

(Joins sheet 85)

R. 6 W. | R. 5 W.

(Joins sheet 92) | (Joins sheet 93)

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 85

(85)

N

1 Mile

5000 Feet

Scale 1:20 000

0 1000 2000 3000 4000 5000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 85

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

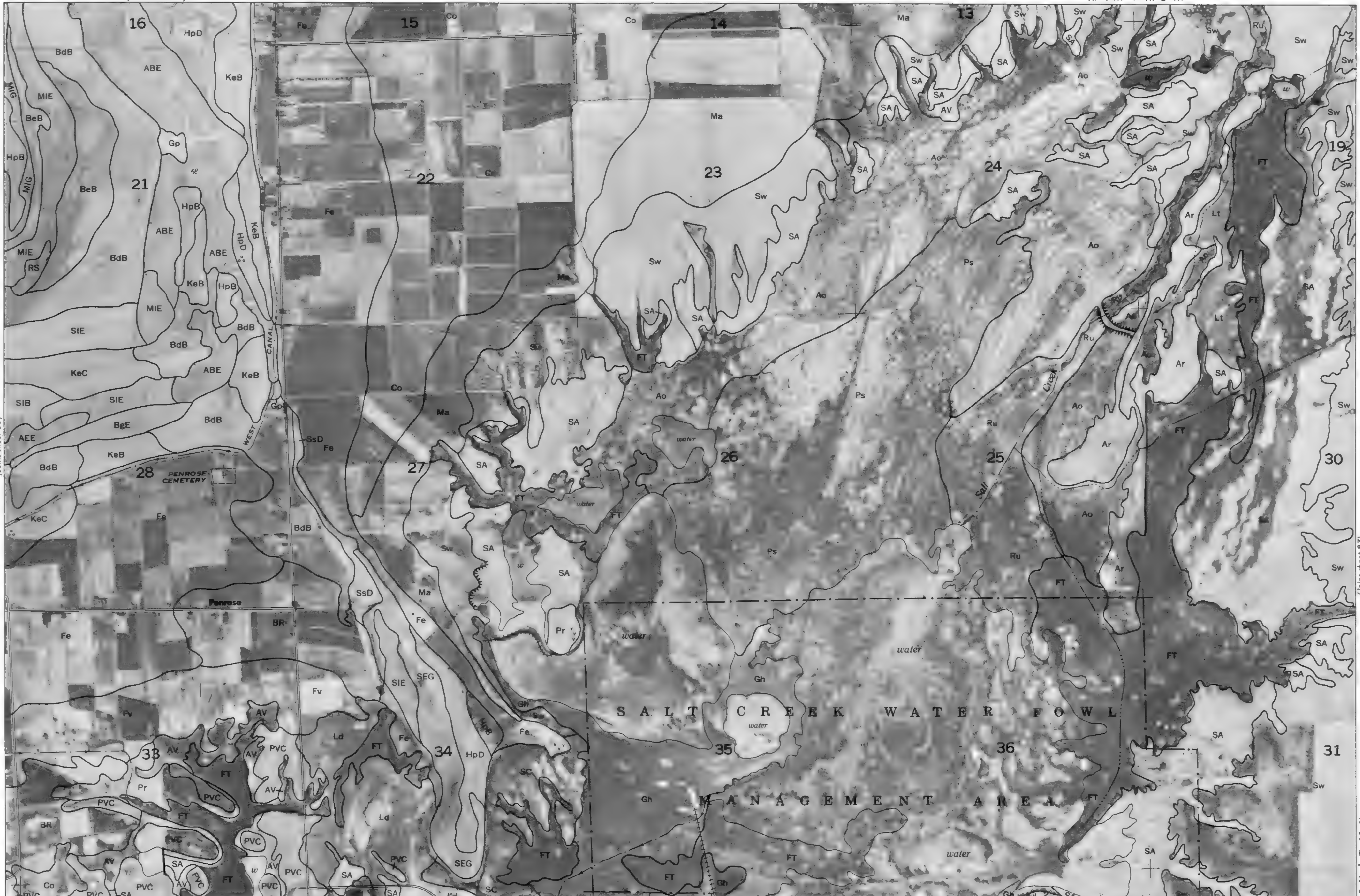
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

N

(Joins sheet 76)

R. 4 W. | R. 3 W.



1 Mile
5000 Feet
Scale 1:20 000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

(Joins sheet 85)

(Joins sheet 87)

(Joins sheet 94) | (Joins sheet 95)

T. 10 N. | T. 11 N.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 87

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

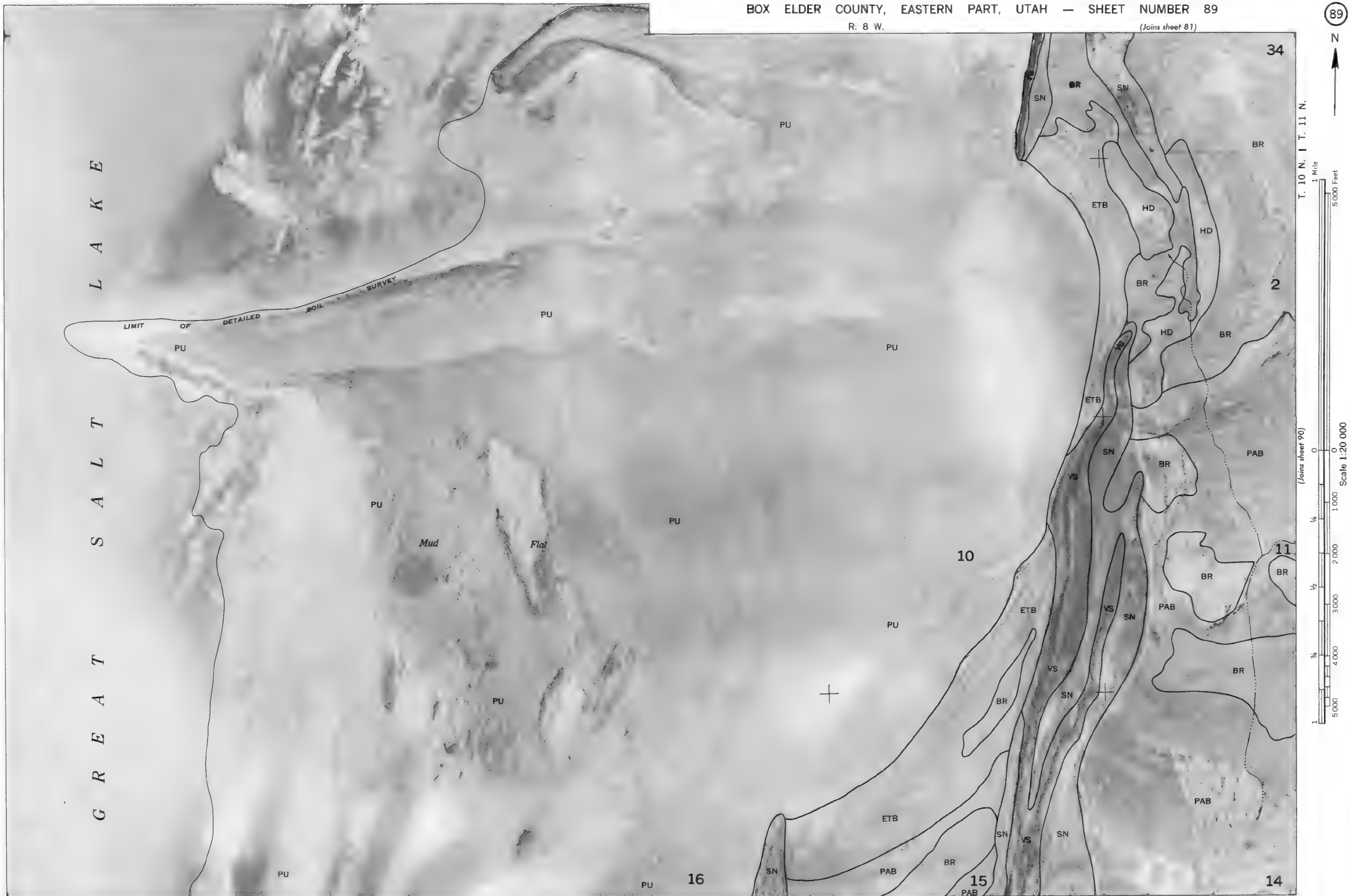
Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 88

R. 3 W. | R. 2 W. (Joins sheet 78)

(Joins sheet 96) | (Joins sheet 97)

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of the Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

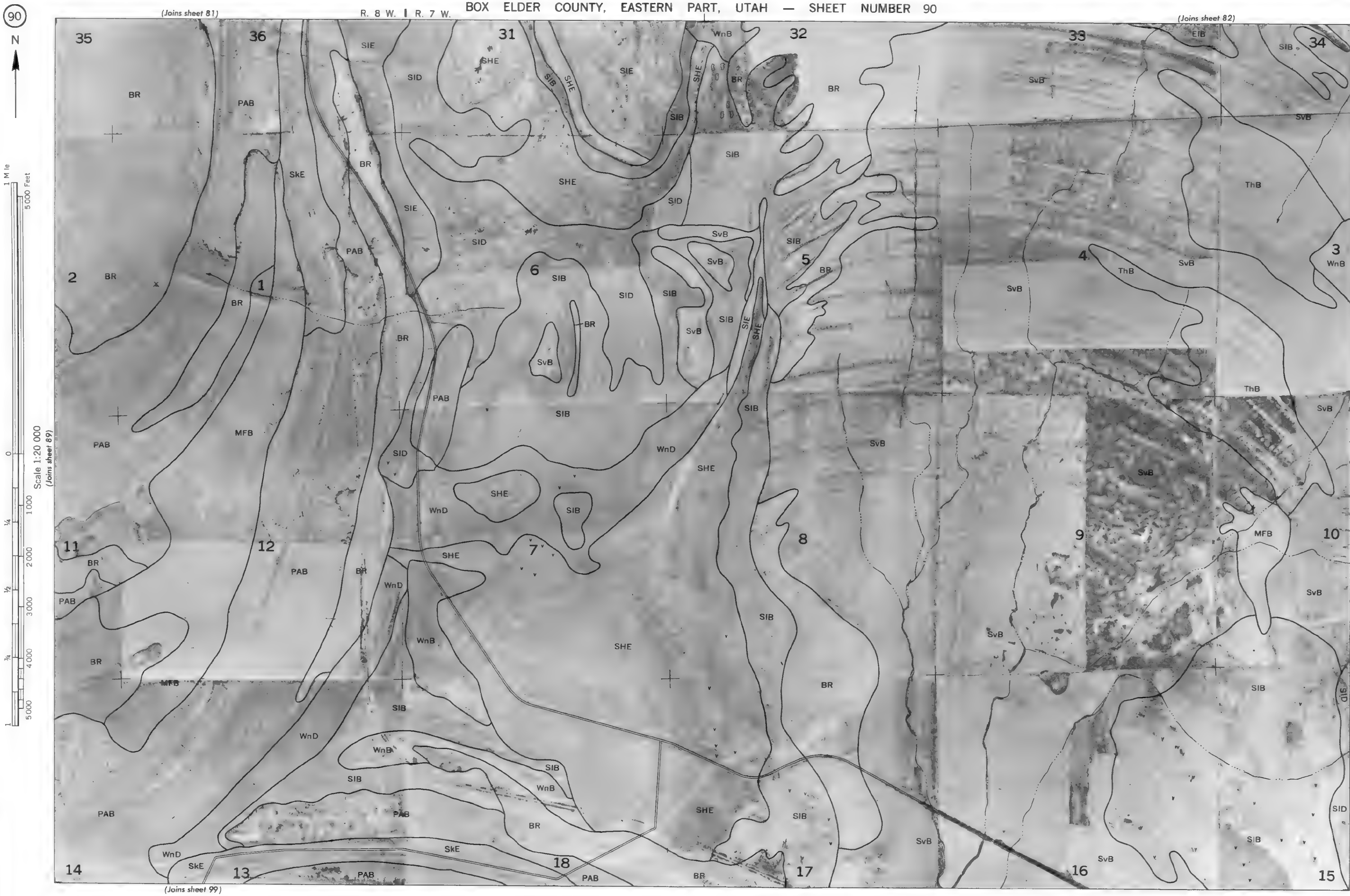


BOX ELDER COUNTY, EASTERN PART, UTAH NO. 89

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 82) | (Joins sheet 83)

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 91

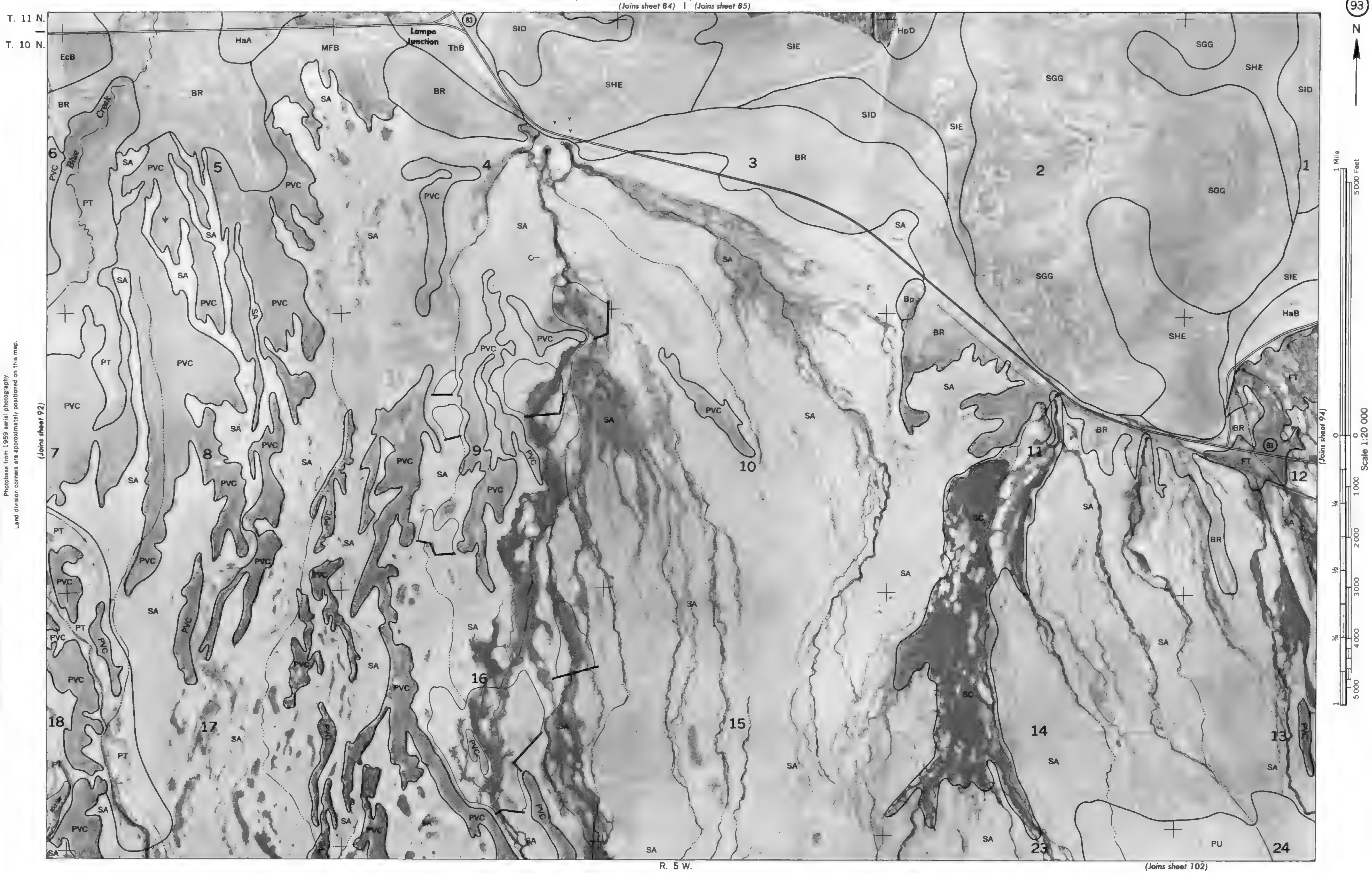
BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 92

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 84) | (Joins sheet 85)



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 93

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

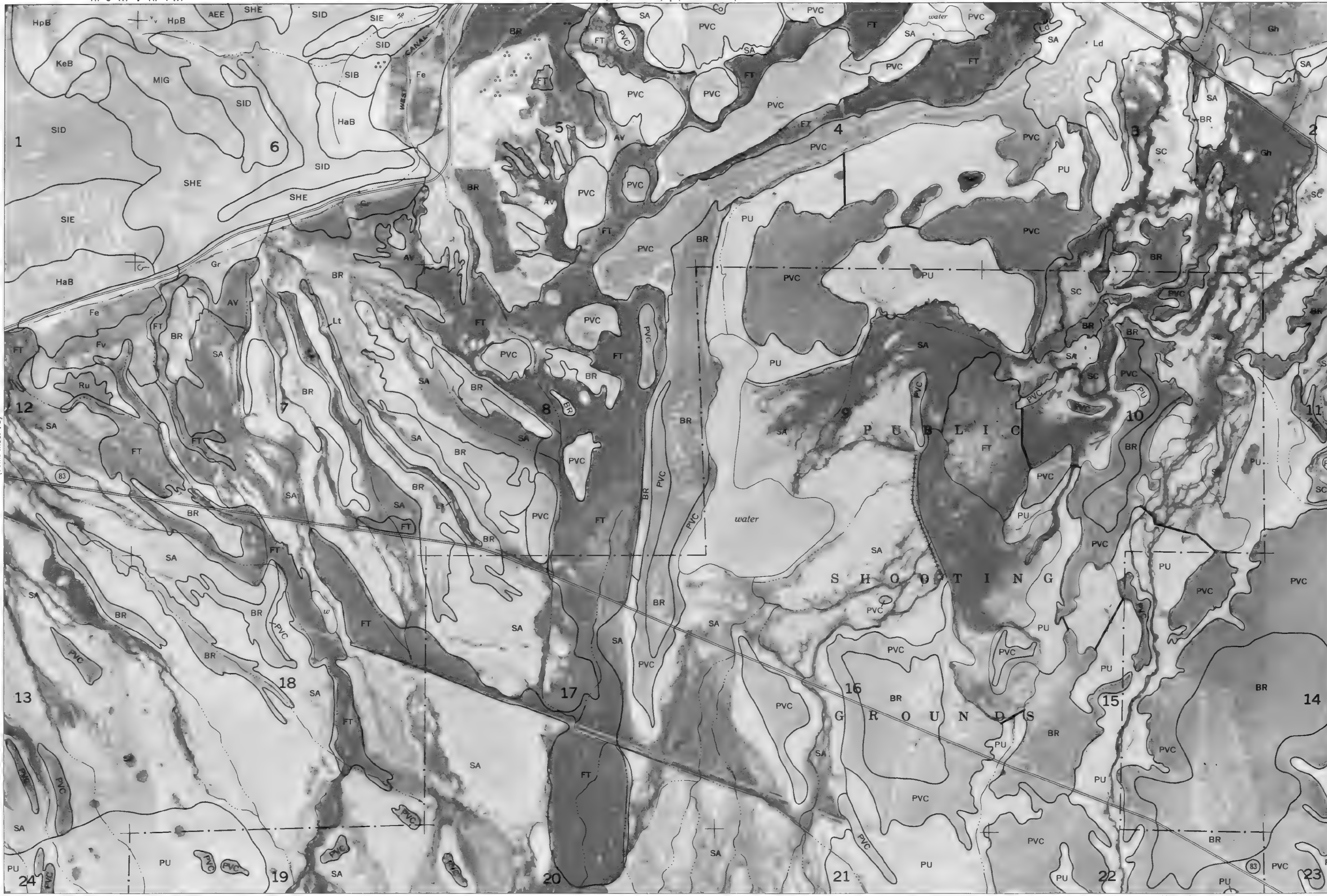
Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 94

N

R. 5 W. | R. 4 W.

(Joins sheet 85) | (Joins sheet 86)



Scale 1:20 000

1 Mile

5000 Feet

0 1/4 1/2 3/4 1

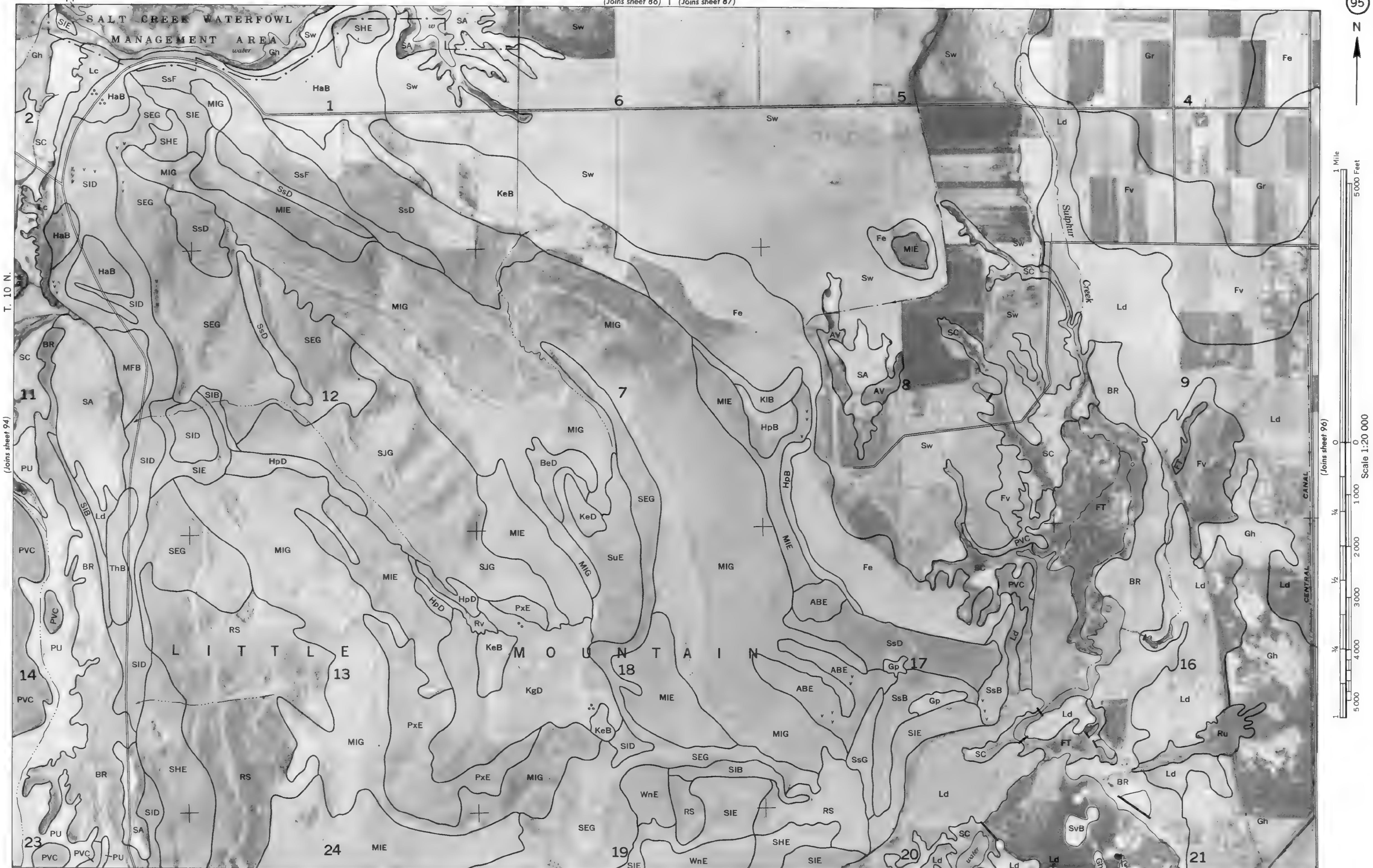
0 1000 2000 3000 4000 5000

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 94



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 95

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

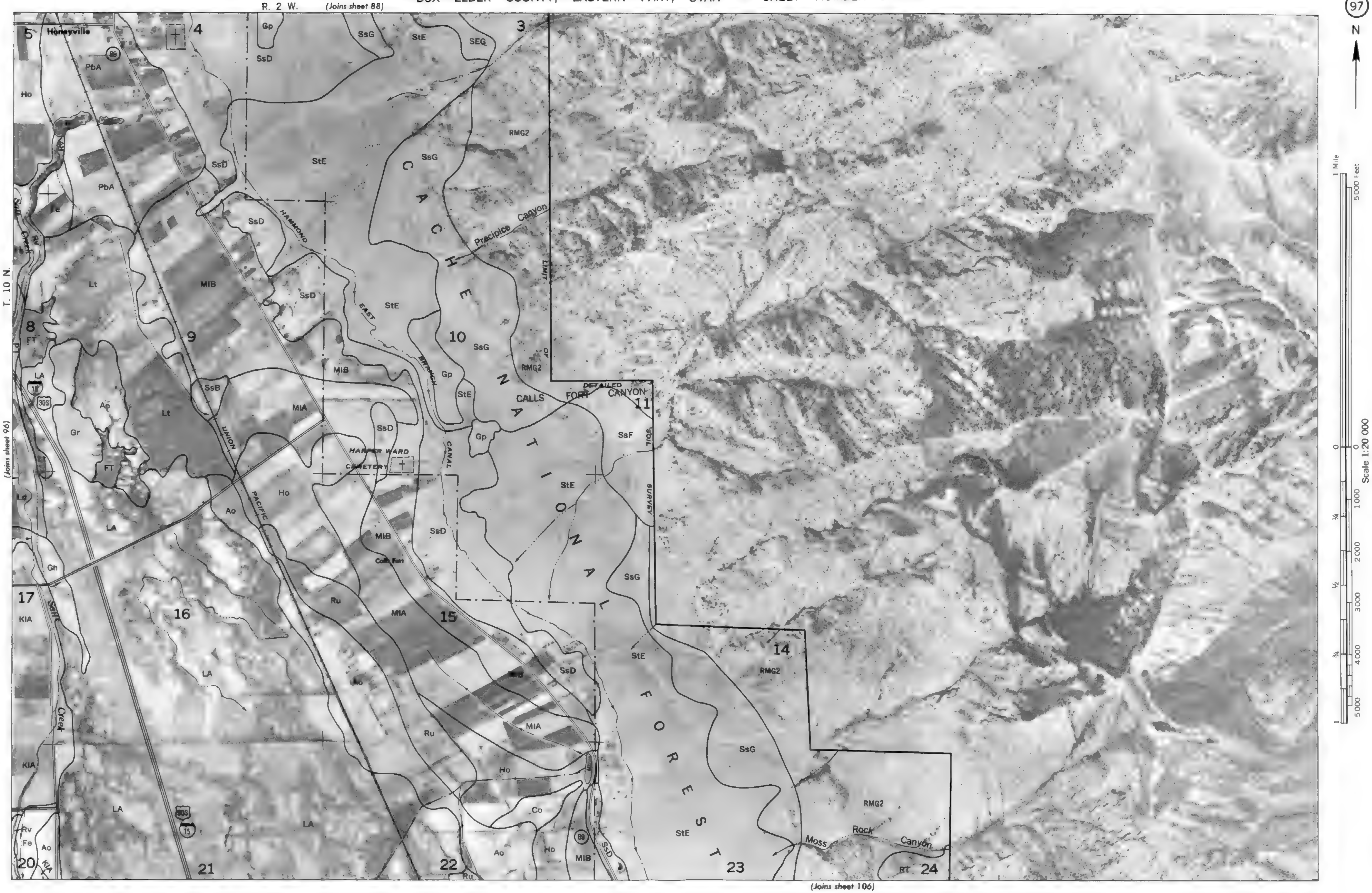
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 96

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 97



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 97

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

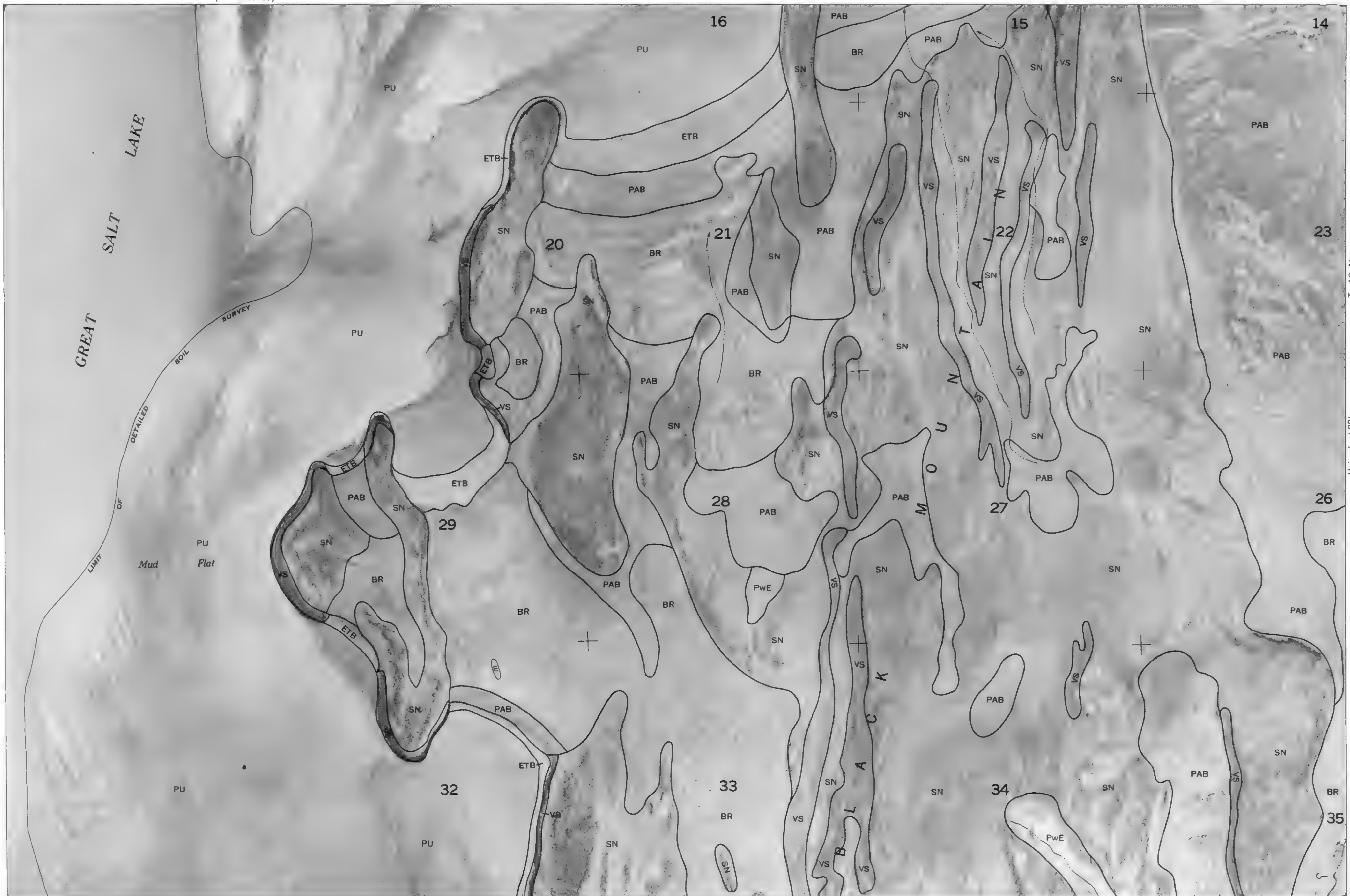
Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 98

(Joins sheet 89)

N

1 Mile
5000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000



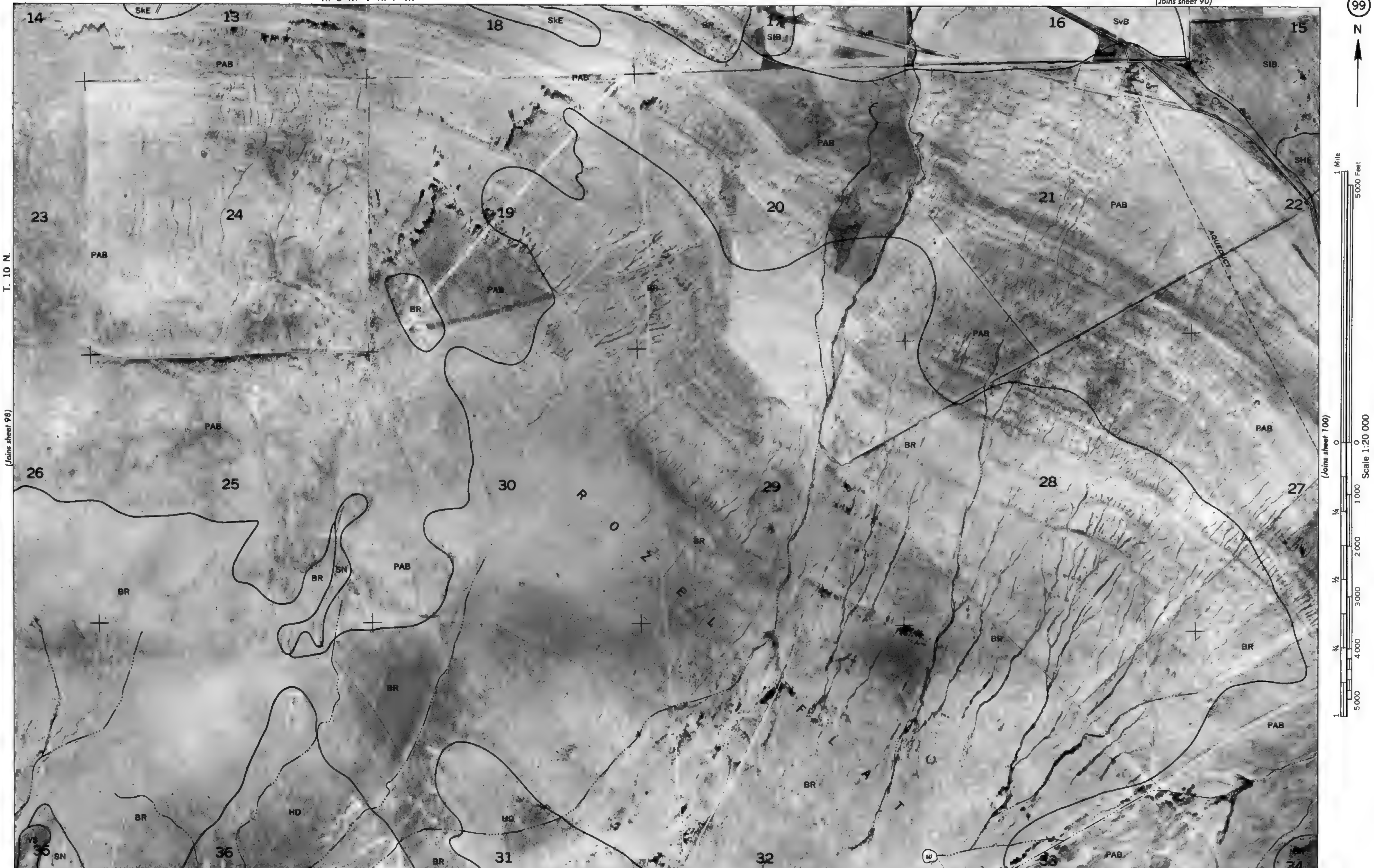
(Joins sheet 99)

(Joins sheet 107)

R. 8 W.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 90)



(Joins sheet 108)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 99

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

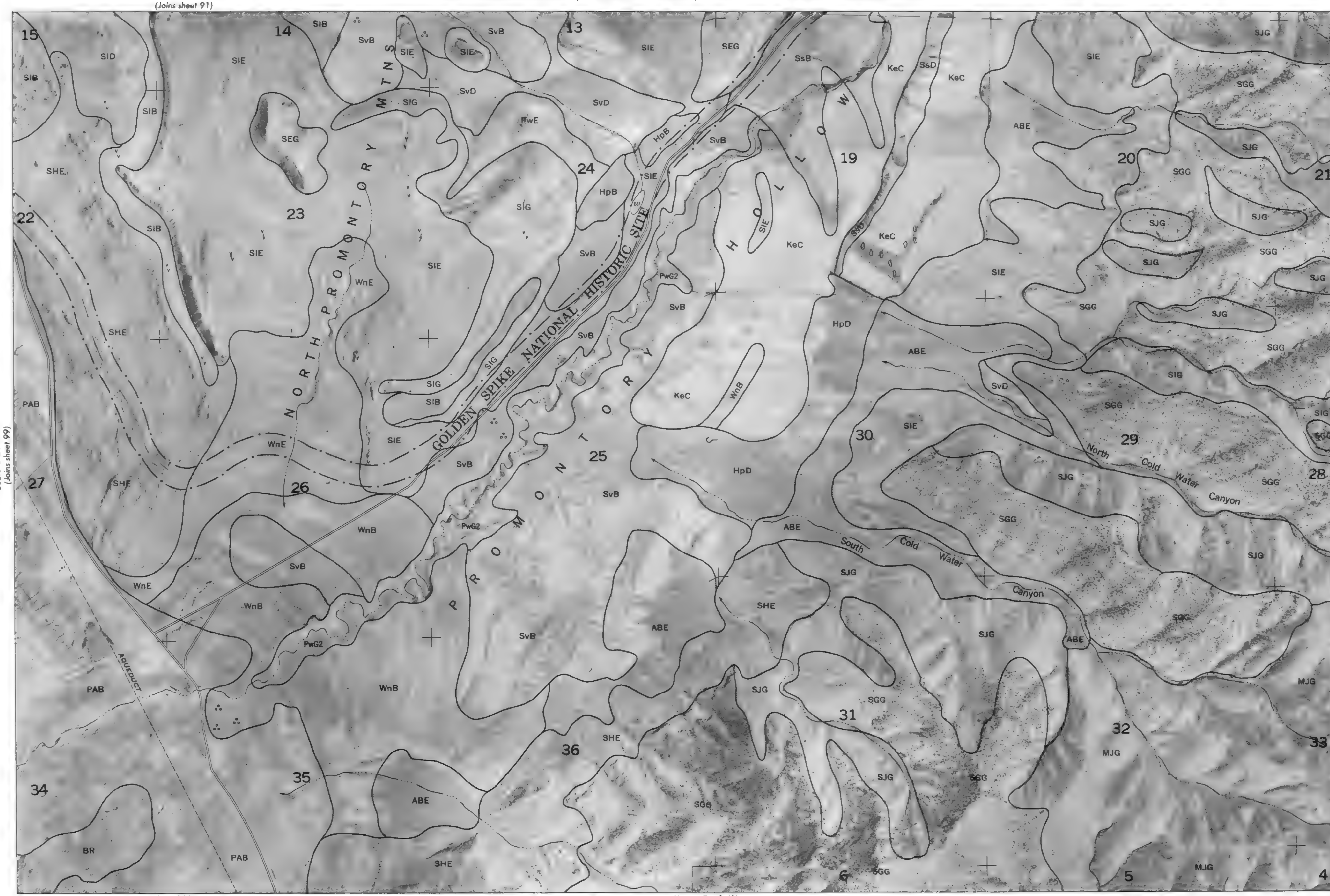
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

100

N

(Joins sheet 91)



Scale 1:20 000

1 Mile

5000 Feet

(Joins sheet 99)

(Joins sheet 101)

(Joins sheet 109)

R. 7 W. | R. 6 W.

T. 9 N. | T. 10 N.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 101

R. 6 W. | R. 5 W. (Joins sheet 92)

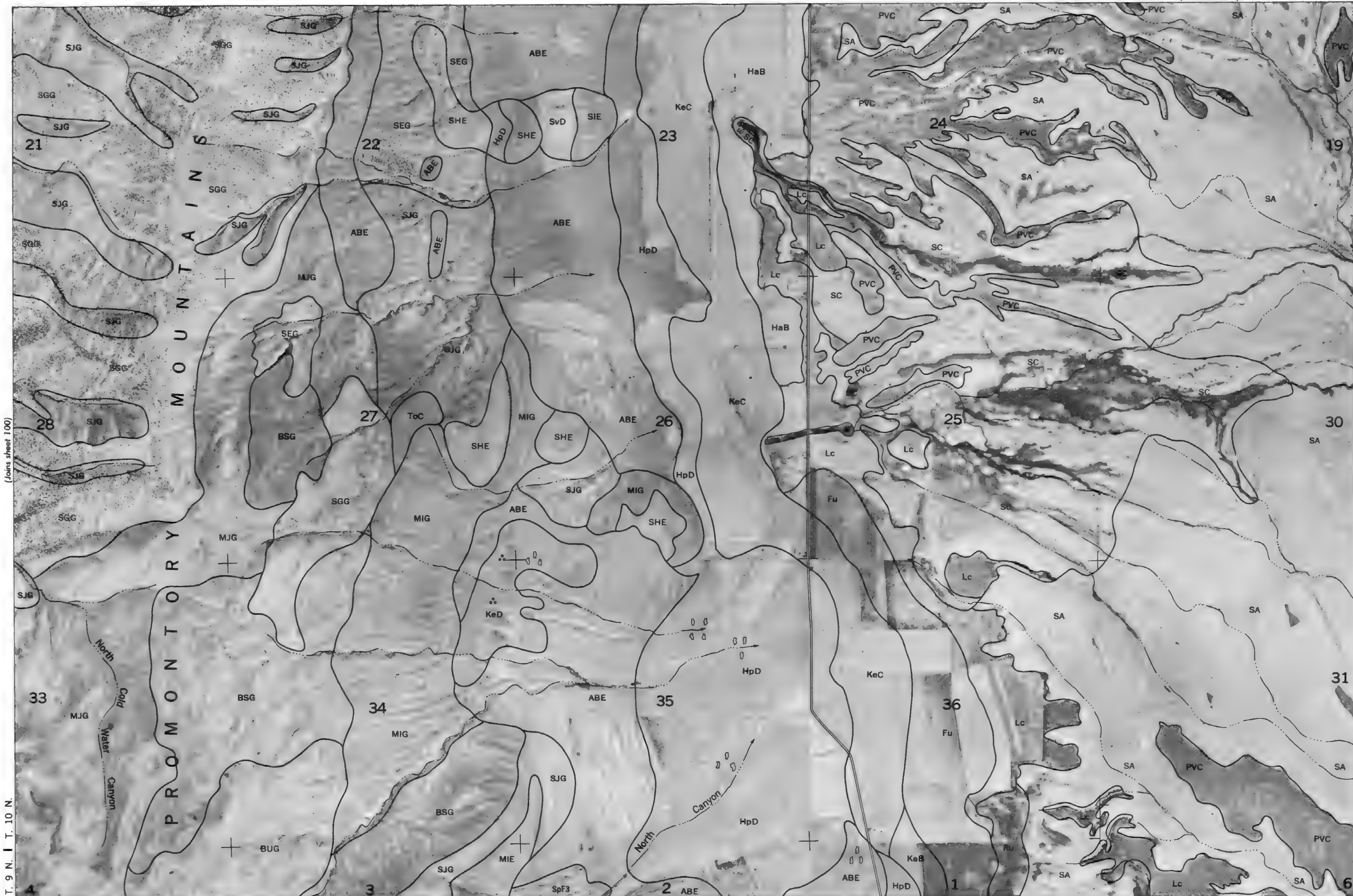
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 101

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

(Joins sheet 100)



101

N

1 Mile

5000 Feet

Scale 1:20 000

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

(Joins sheet 102)

(Joins sheet 110)

102

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 102

(Joins sheet 93)

N

Scale 1:20 000

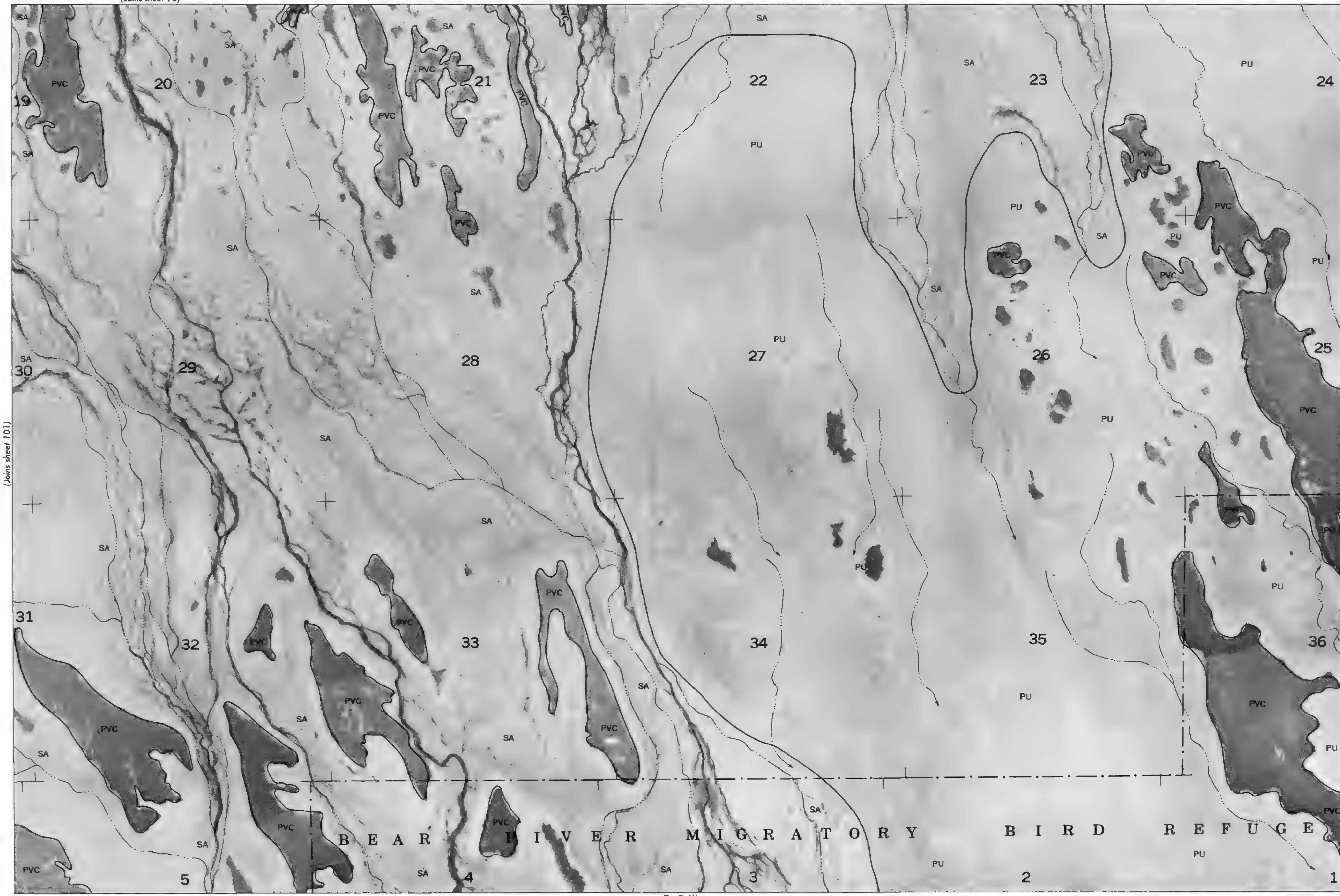
1 Mile

0 ¼ ½ ¾ 1

5000 Feet

0 1000 2000 3000 4000 5000

(Joins sheet 101)



(Joins sheet 103)

T. 10 N.

T. 9 N.

R. 5 W.

(Joins sheet 111)

Land division corners are approximately positioned on this map.

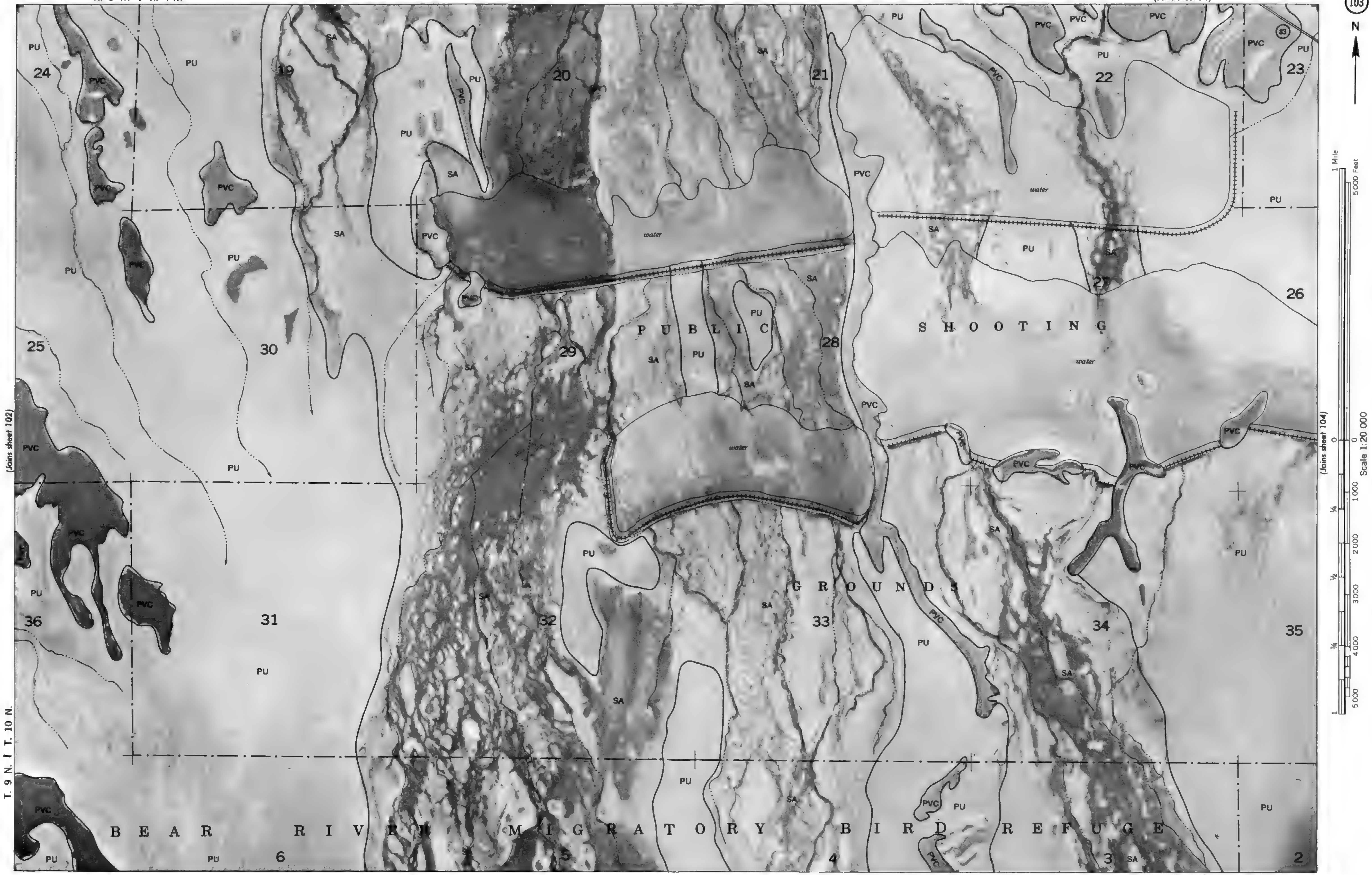
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 102

(103)

R. 5 W. | R. 4 W. (Joins sheet 94)



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 103

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(105)

(Joins sheet 96)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 105

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

(Joins sheet 104)

T. 10 N. | T. 9 N.

(Joins sheet 106)

N

Scale 1:20 000

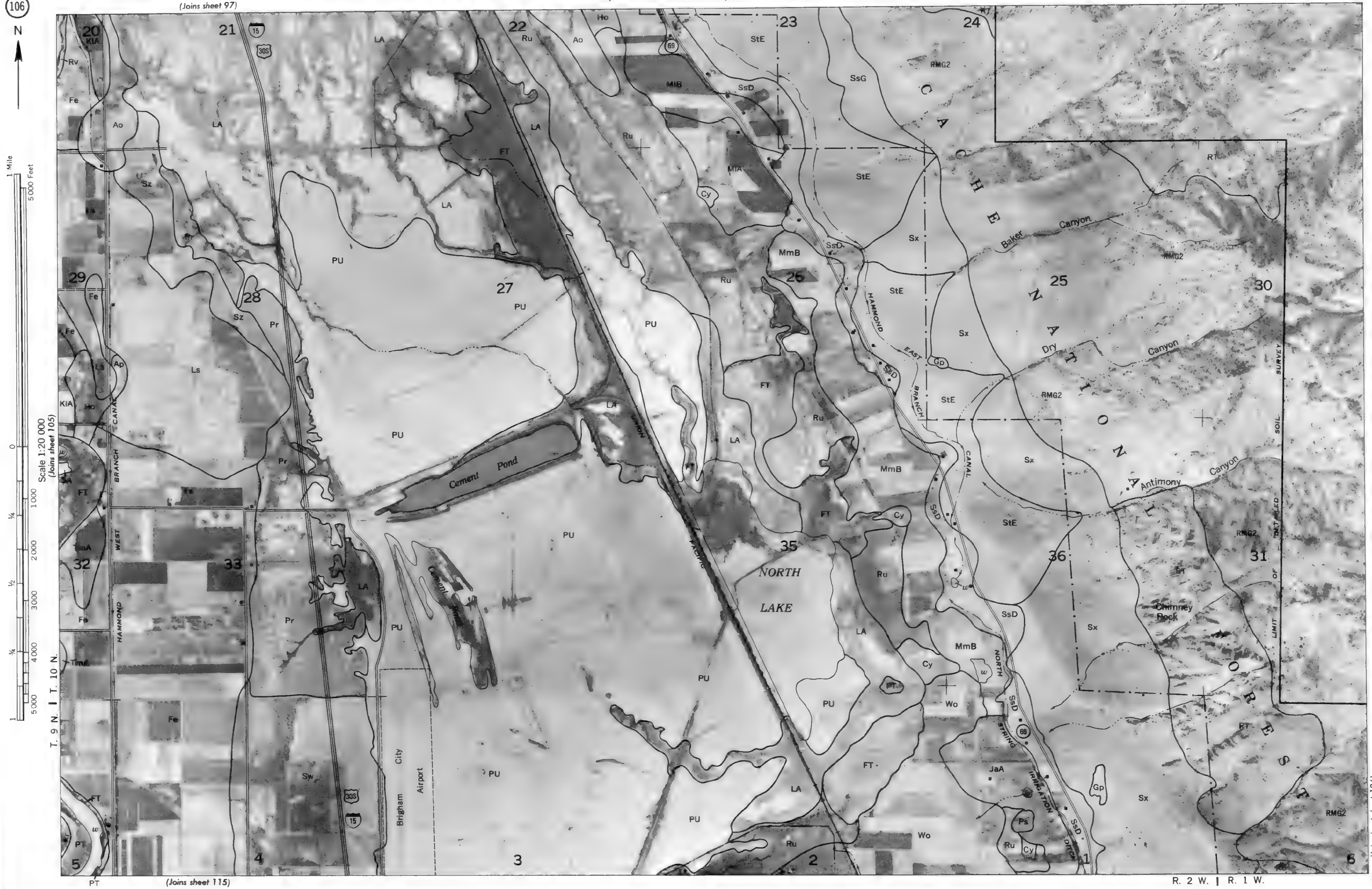
1 Mile

5000 Feet

(Joins sheet 114)

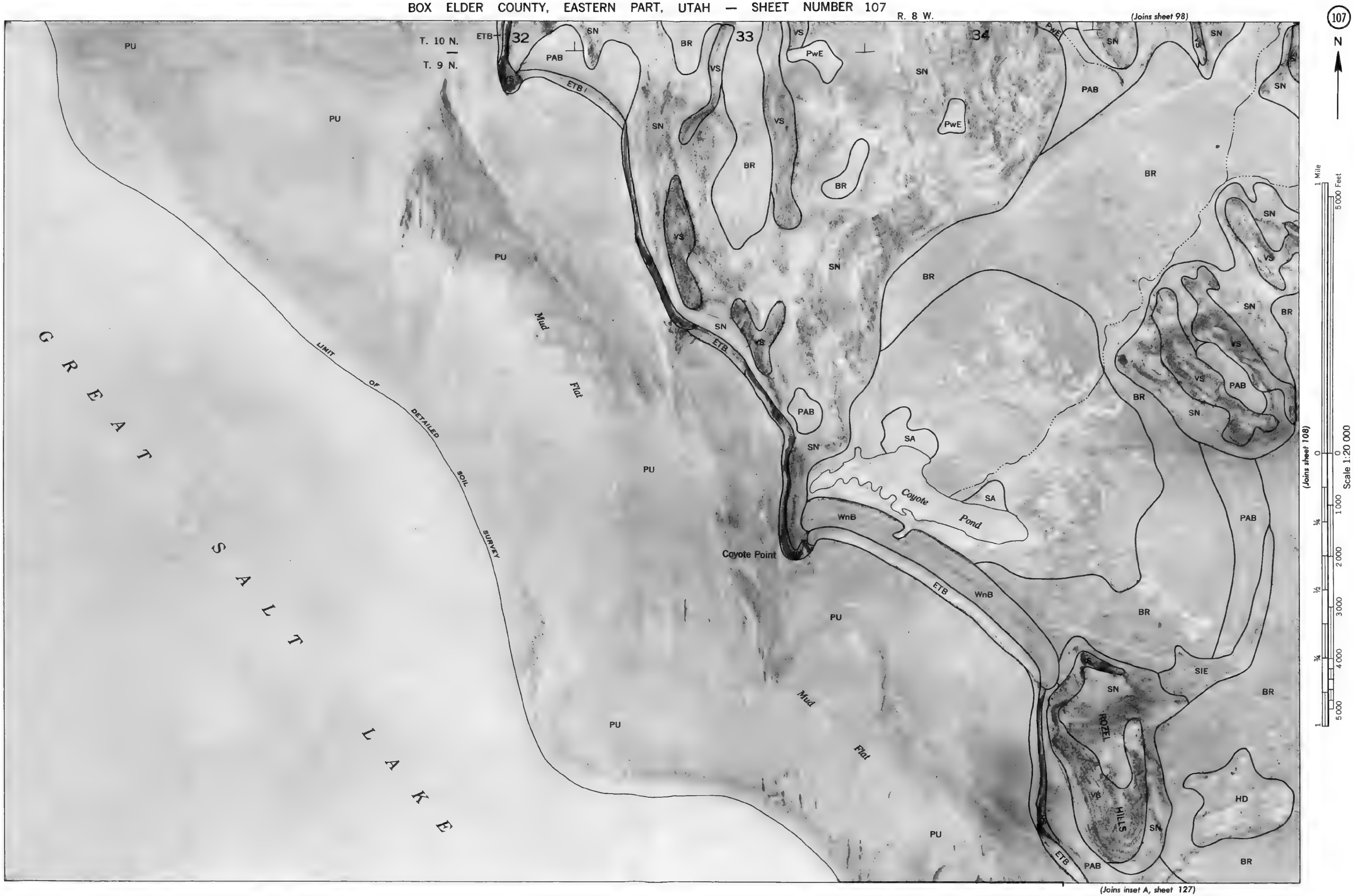
R. 3 W. | R. 2 W.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 106



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 107



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 107

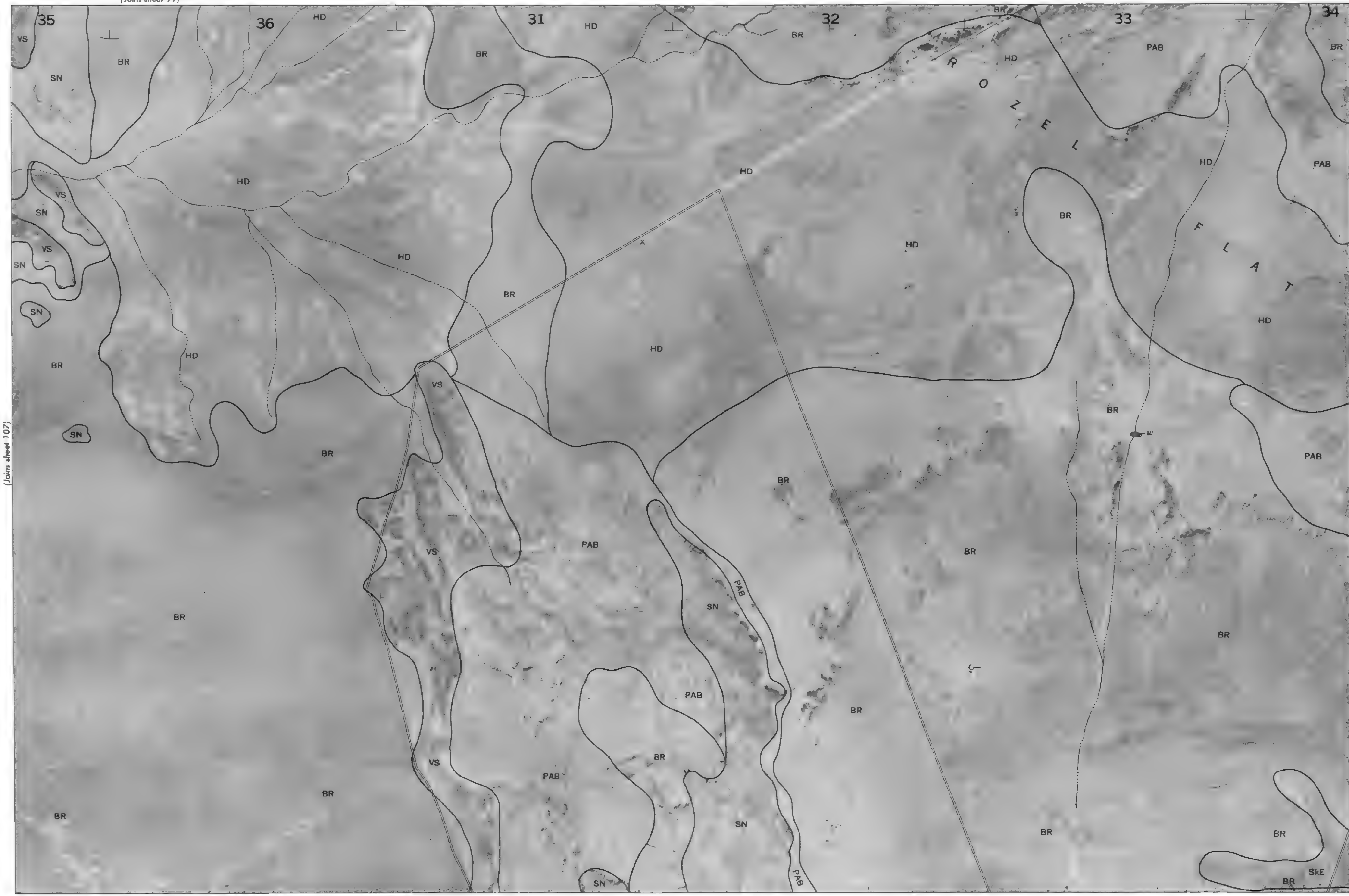
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 108

(Joins sheet 99)



(Joins sheet 107)

(Joins sheet 109)

(Joins sheet 117)

R. 8 W. | R. 7 W.

N

Scale 1:20 000

1 Mile

5000 Feet

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(109)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 109

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

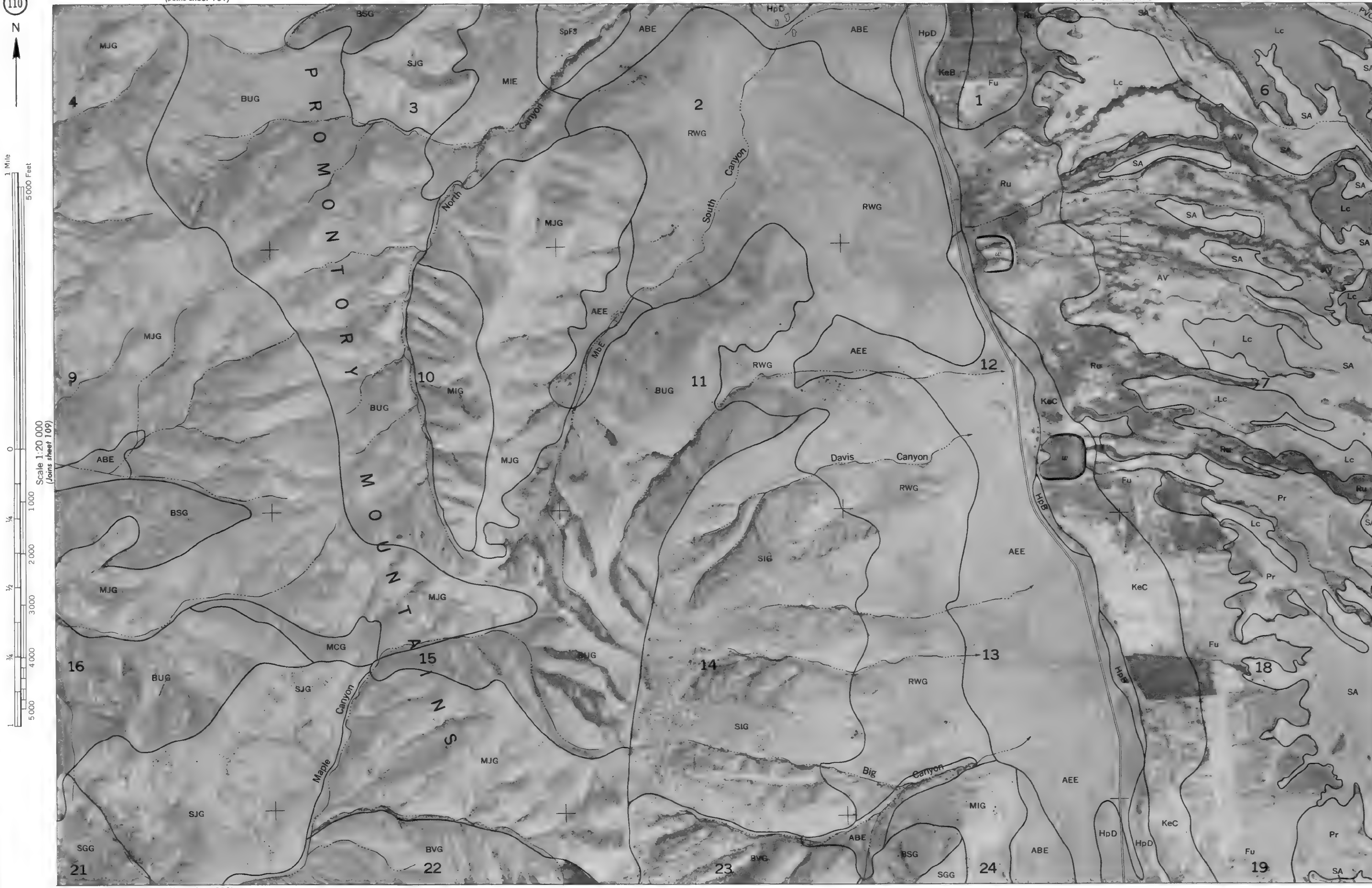
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 110

R. 6 W. | R. 5 W.

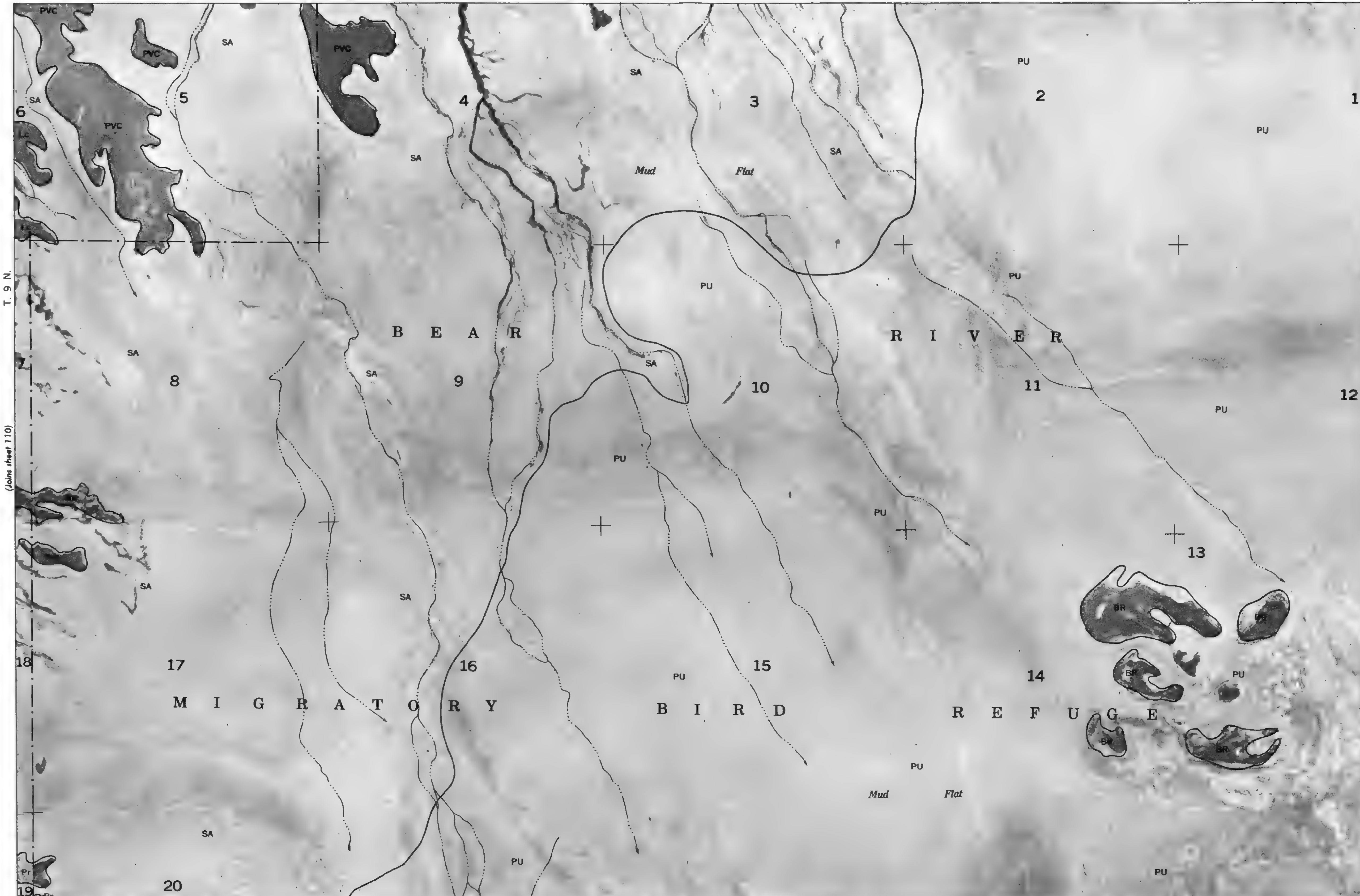
(Joins sheet 101)



(Joins sheet 119)

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 102)



R. 5 W.

(Joins sheet 120)

N

Scale 1:20 000

1 Mile ¾ ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 111

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

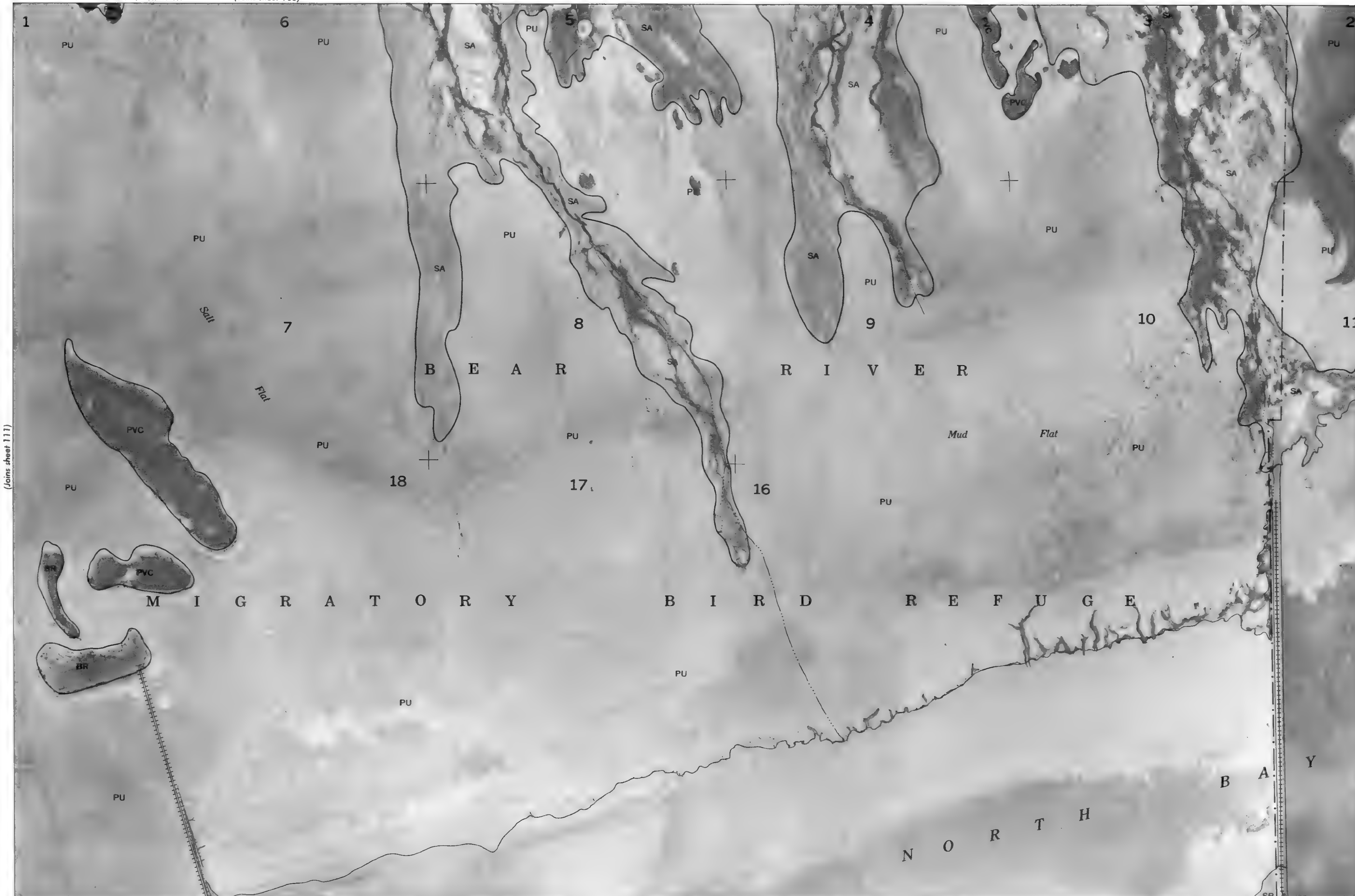
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 112

R. 5 W. | R. 4 W. (Joins sheet 103)

N



Scale 1:20 000 (Joins sheet 111)

1 Mile
5000 Feet
0 1000 2000 3000 4000 5000

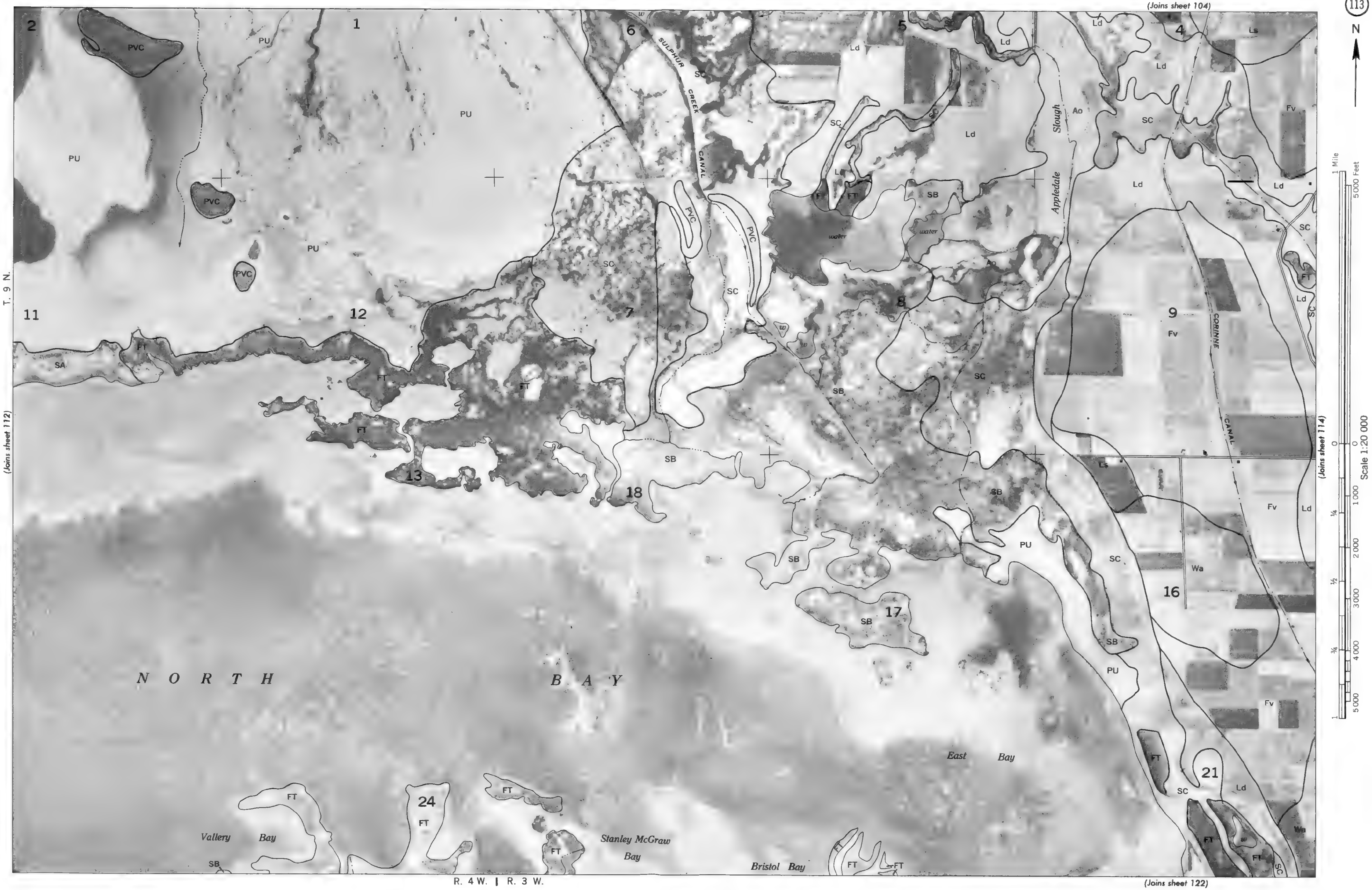
(Joins sheet 121)

(Joins sheet 113)

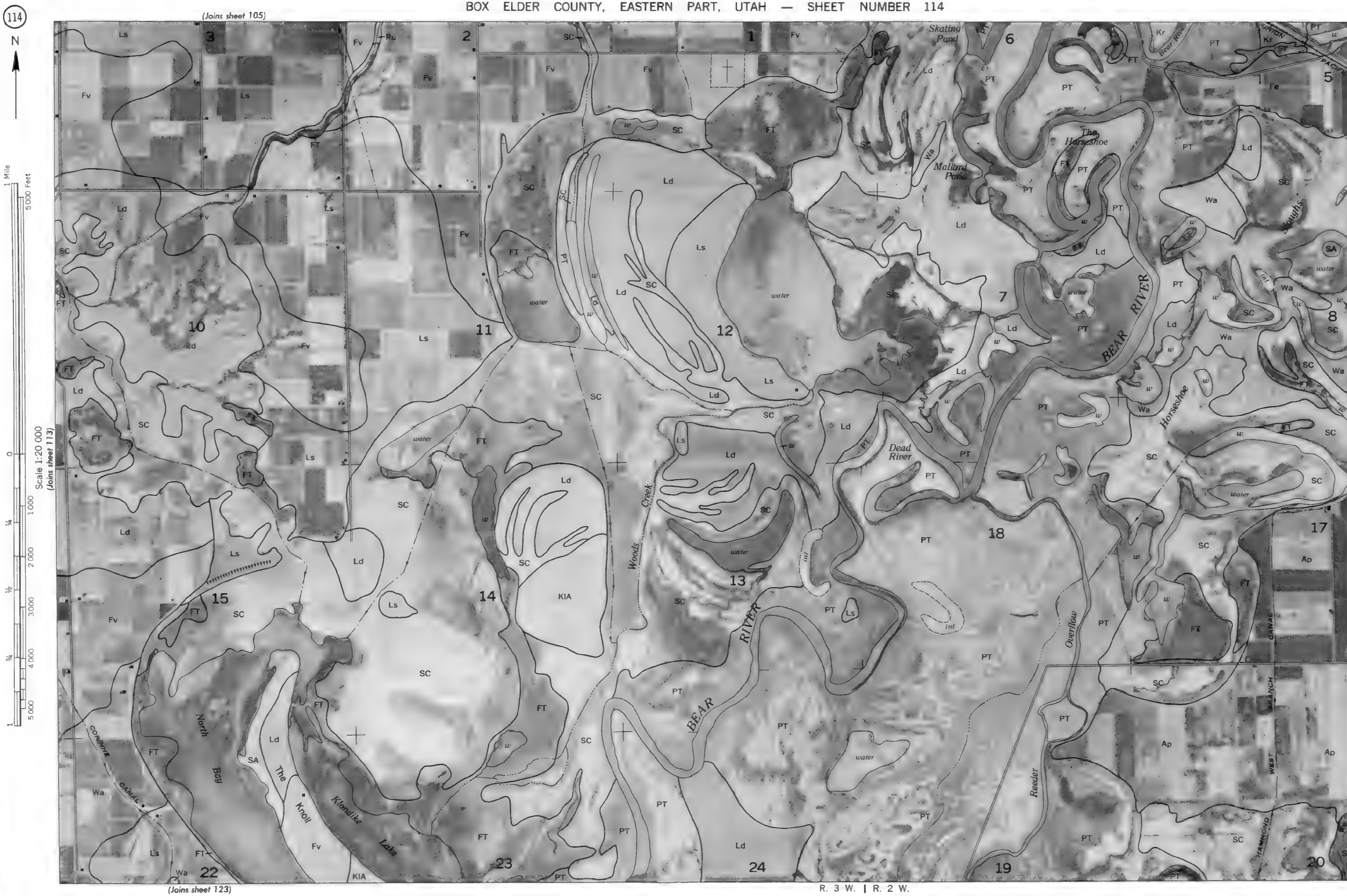
T. 9 N.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 113
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.
Photobase from 1959 aerial photography.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

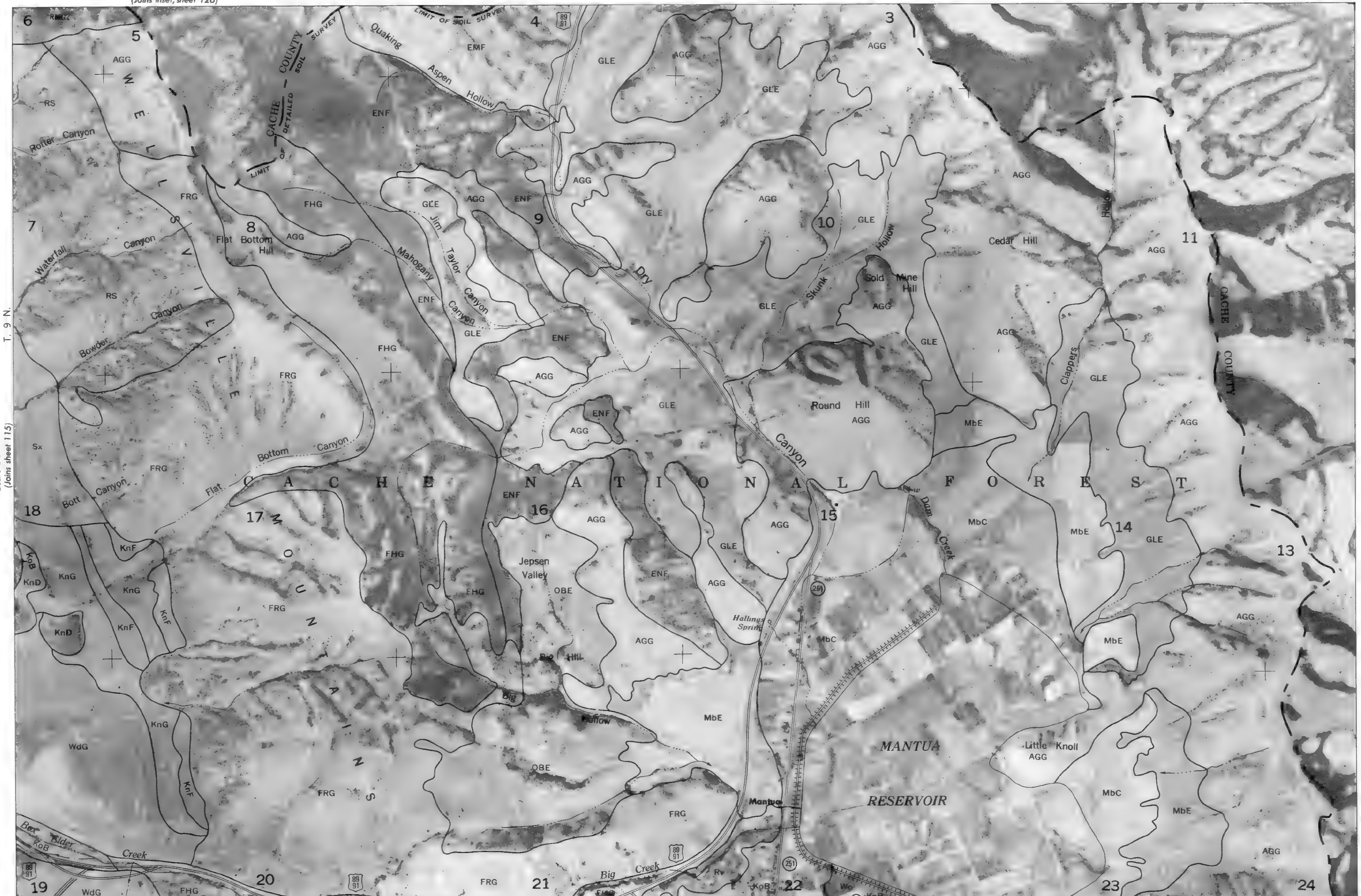
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 115

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map

(Joins inset, sheet 126)



(Joins sheet 115)

(Joins sheet 125)

N

Scale 1:20 000

1 Mile

5000 Feet

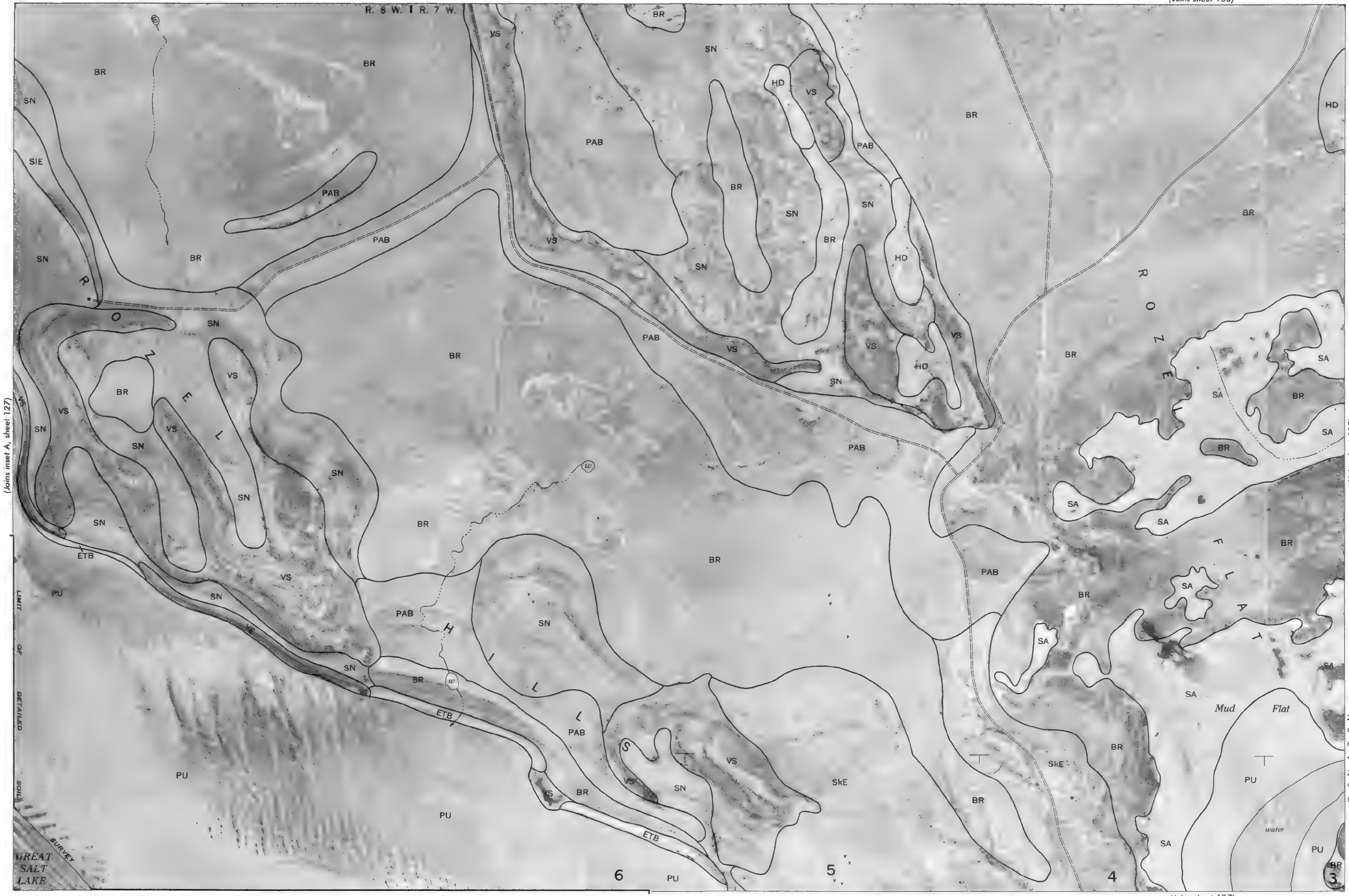
0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

117

(Joins sheet 108)



N

Scale 1:20 000

1 Mile

5000 Feet

(Joins sheet 127)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 117

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.

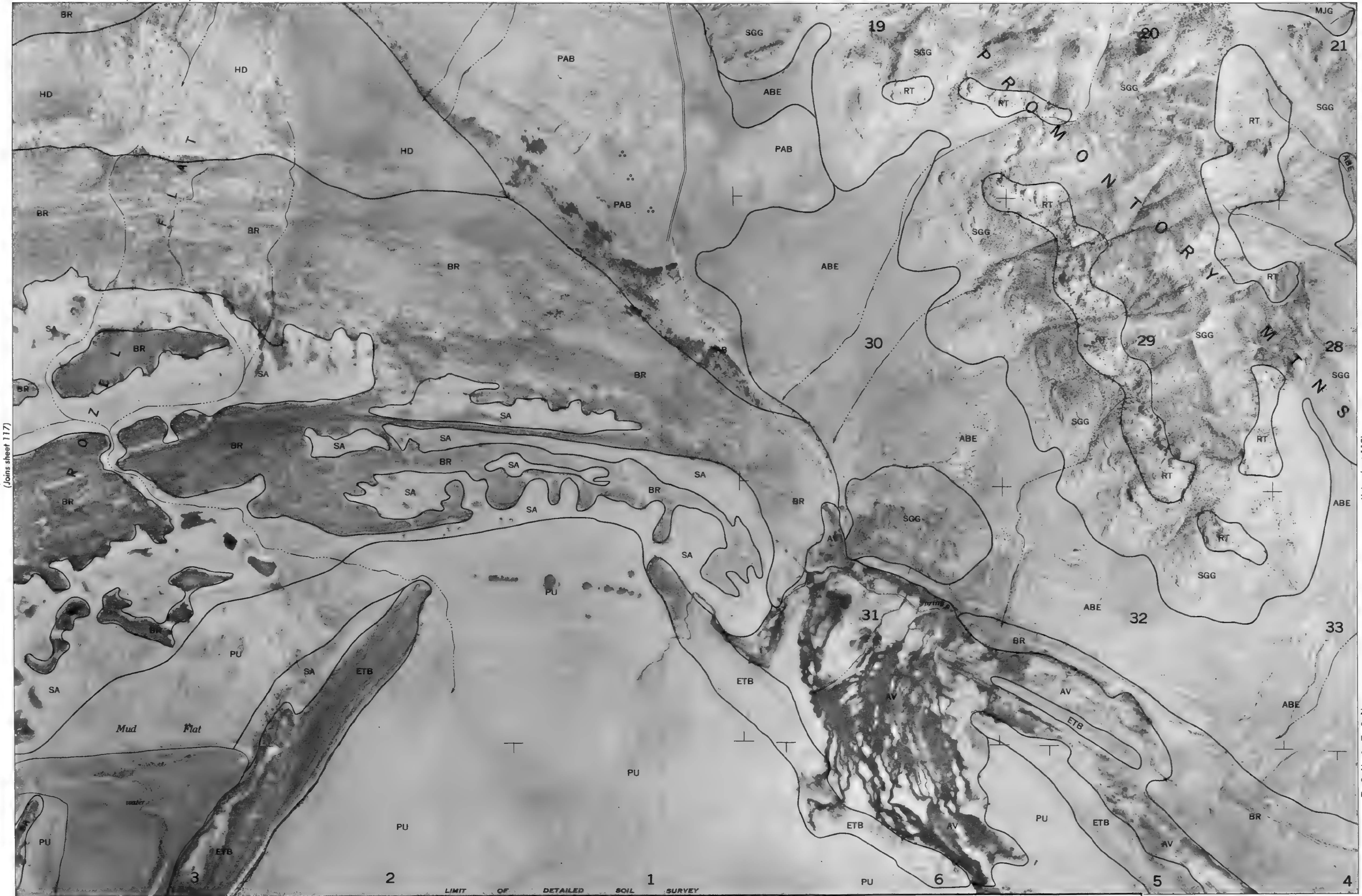
BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 118

N

Scale 1:20 000

1 Mile

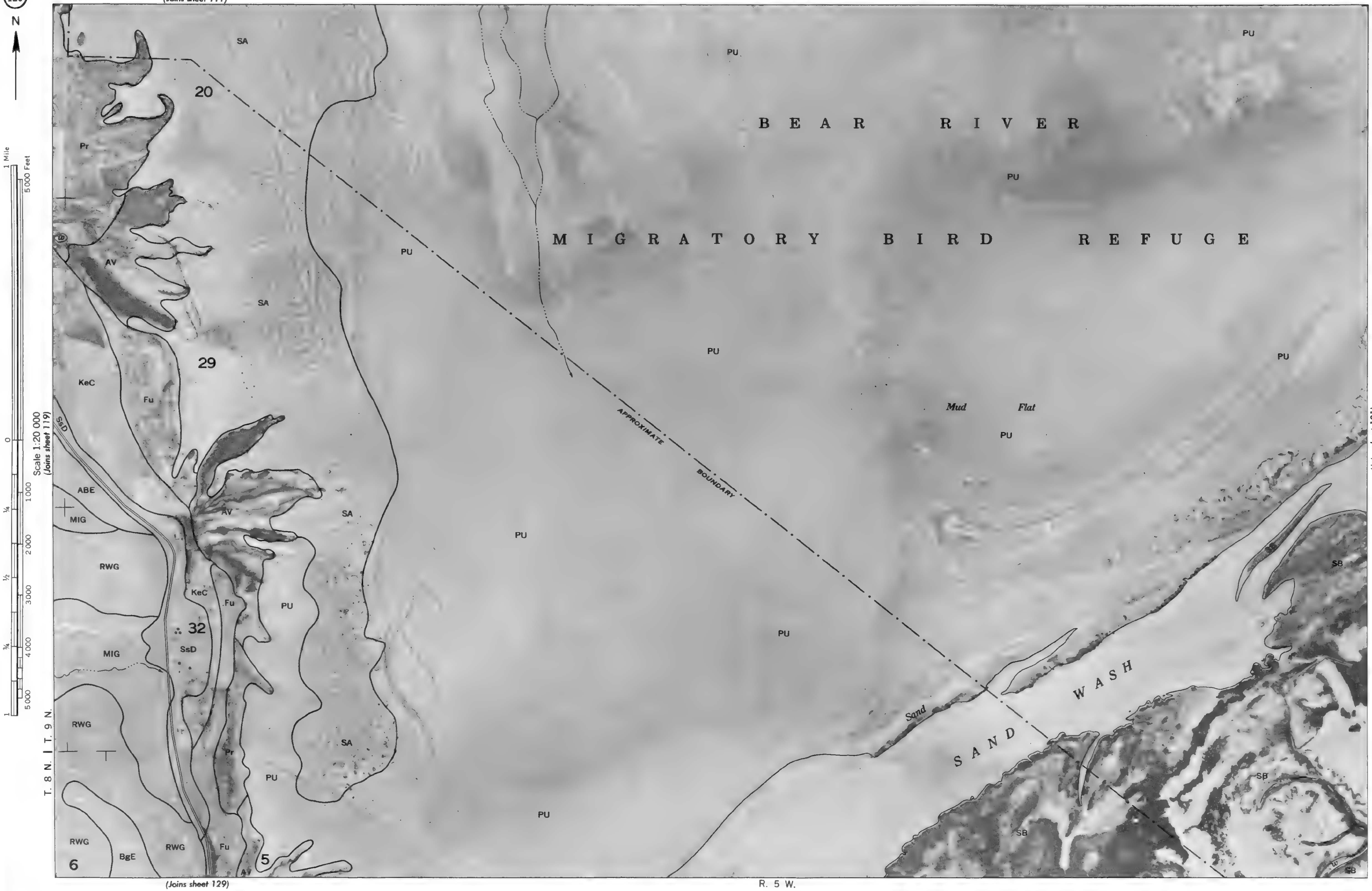
5000 Feet



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management; and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 119
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.
Photobase from 1959 aerial photography
Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 120



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 112)

121

N

1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
Scale 1:20 000

T. 9 N. | T. 8 N.

(Joins sheet 122)

(Joins sheet 120)

R. 4 W.

(Joins sheet 130)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 121

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

(Joins sheet 113)

N

1 Mile
5000 Feet
0
1000
¼
2000
½
3000
¾
4000
5000
1

Scale 1:20 000
(Joins sheet 121)

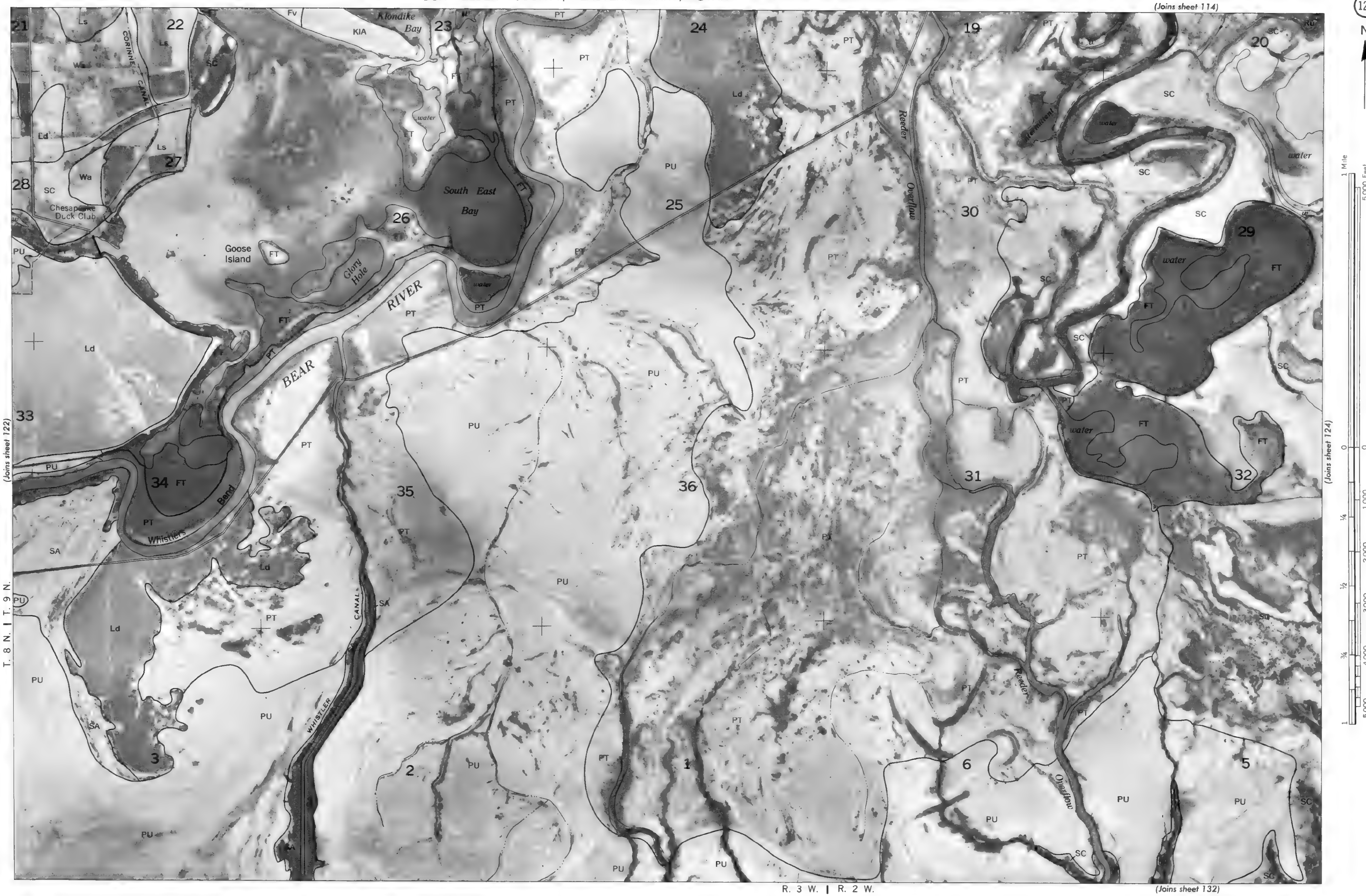
(Joins sheet 131)

R. 4 W. | R. 3 W.

(Joins sheet 123)

T. 8 N. | T. 9 N.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 123

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 124

(125)

(Joins sheet 116)

(Joins sheet 124)

(Joins sheet 126)

(Joins sheet 134)

R. 1 W.

T. 8 N. | T. 9 N.

N

1 Mile

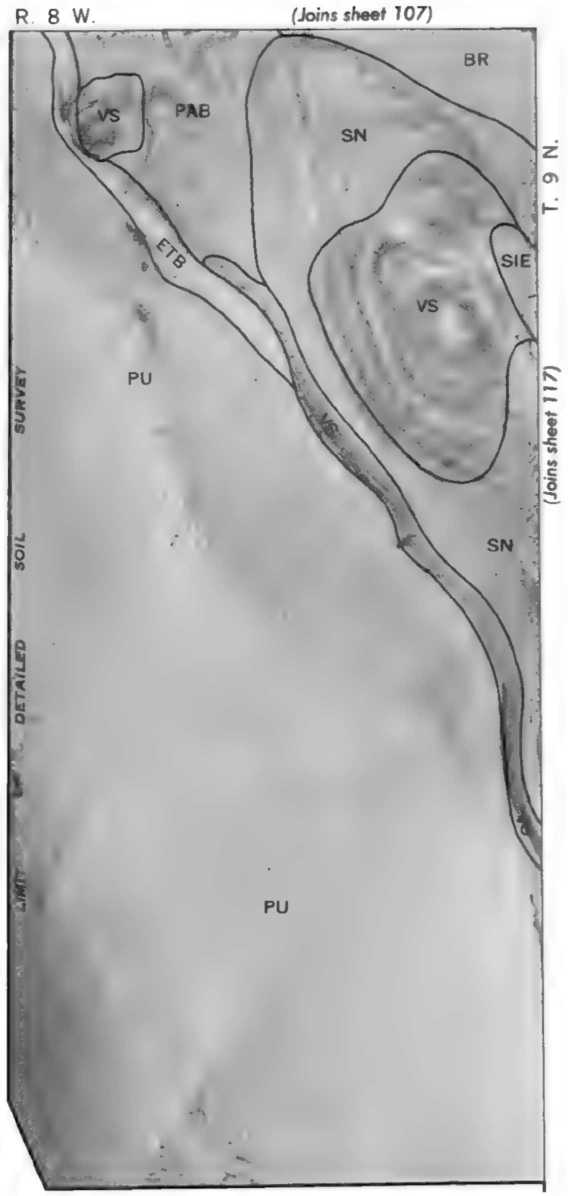
5000 Feet

Scale 1:20 000

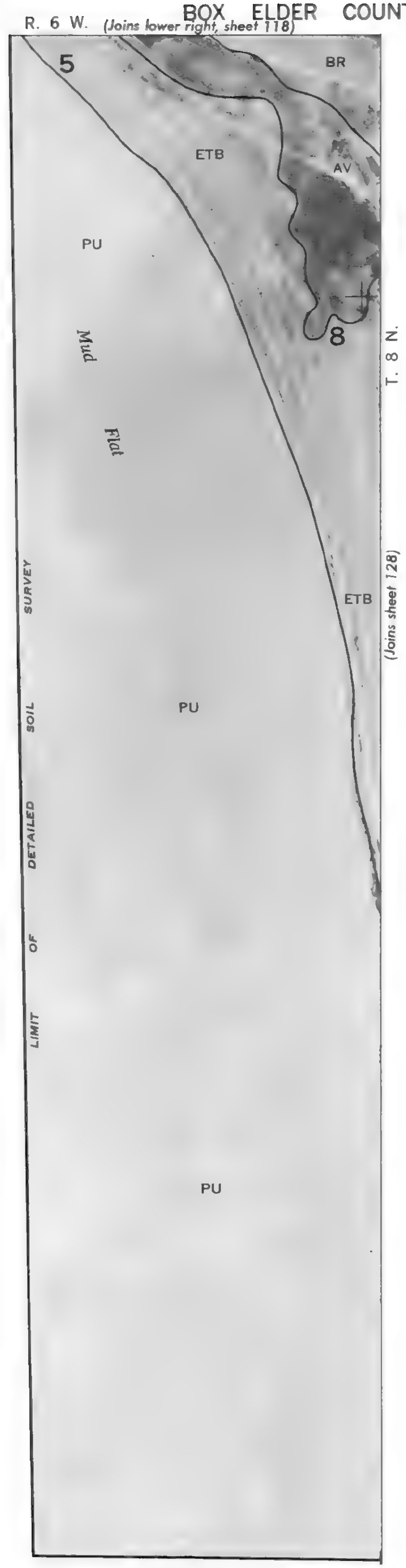
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 125
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.
Photobase from 1959 aerial photography.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management; and the Utah Agricultural Experiment Station.

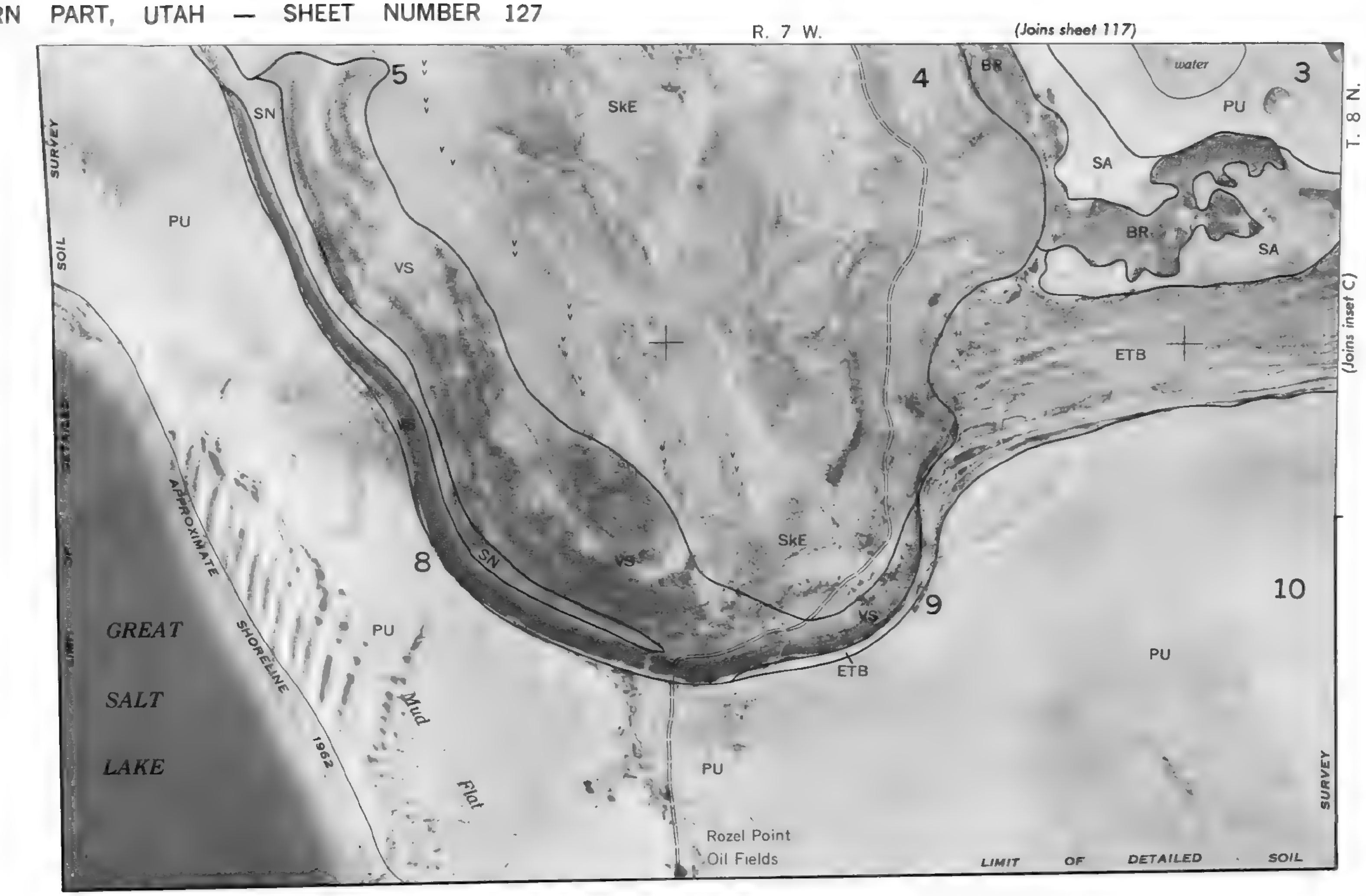
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 127
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.
Photobase from 1959 aerial photography.
Land division corners are approximately positioned on this map.

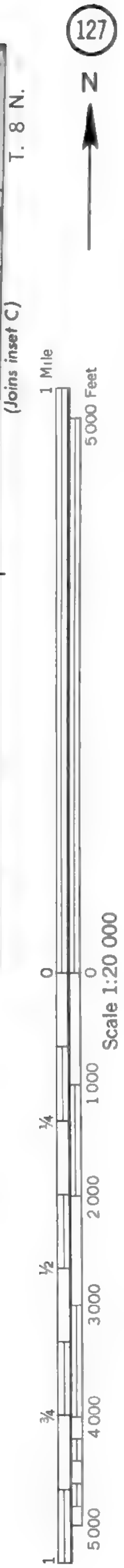


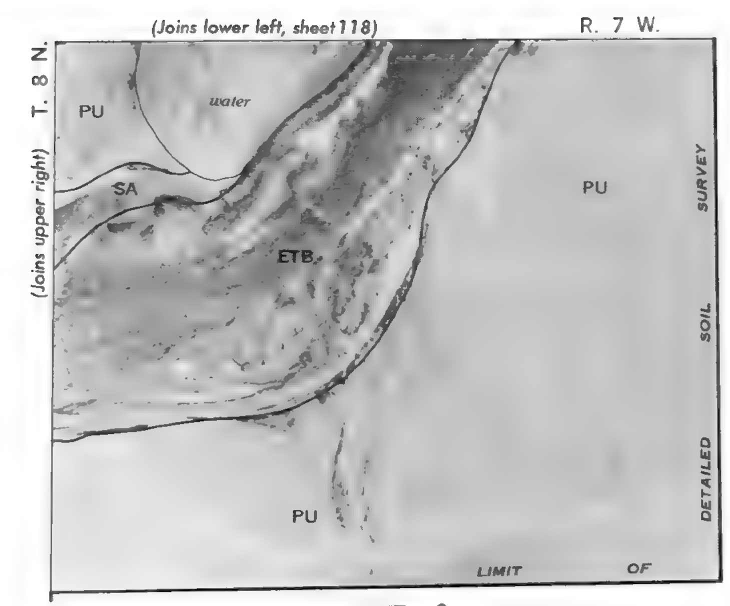
INSET A



INSET B

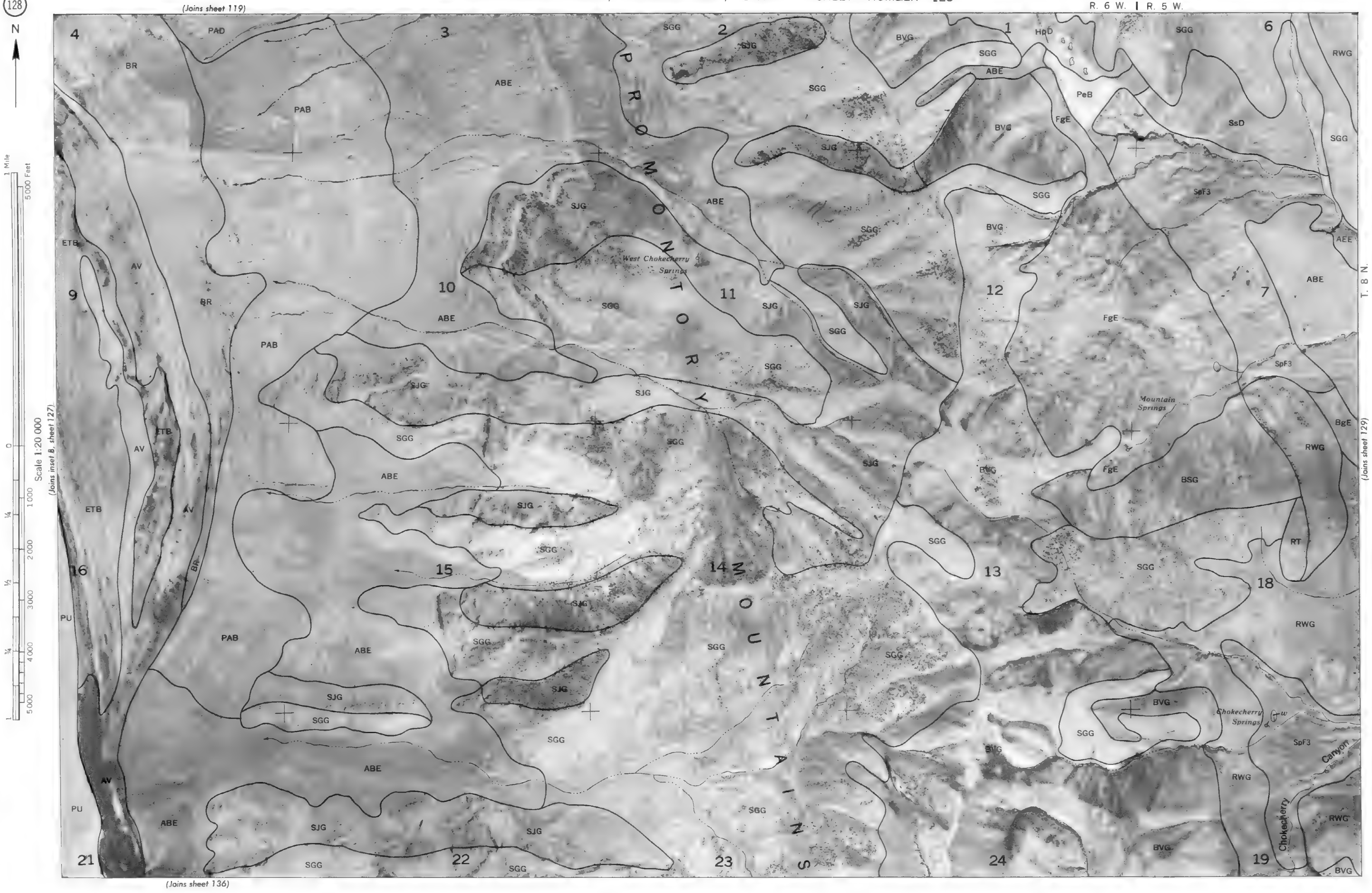






INSET C

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 128



Land division corners are approximately positioned on this map
Photobase from 1959 aerial photography

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

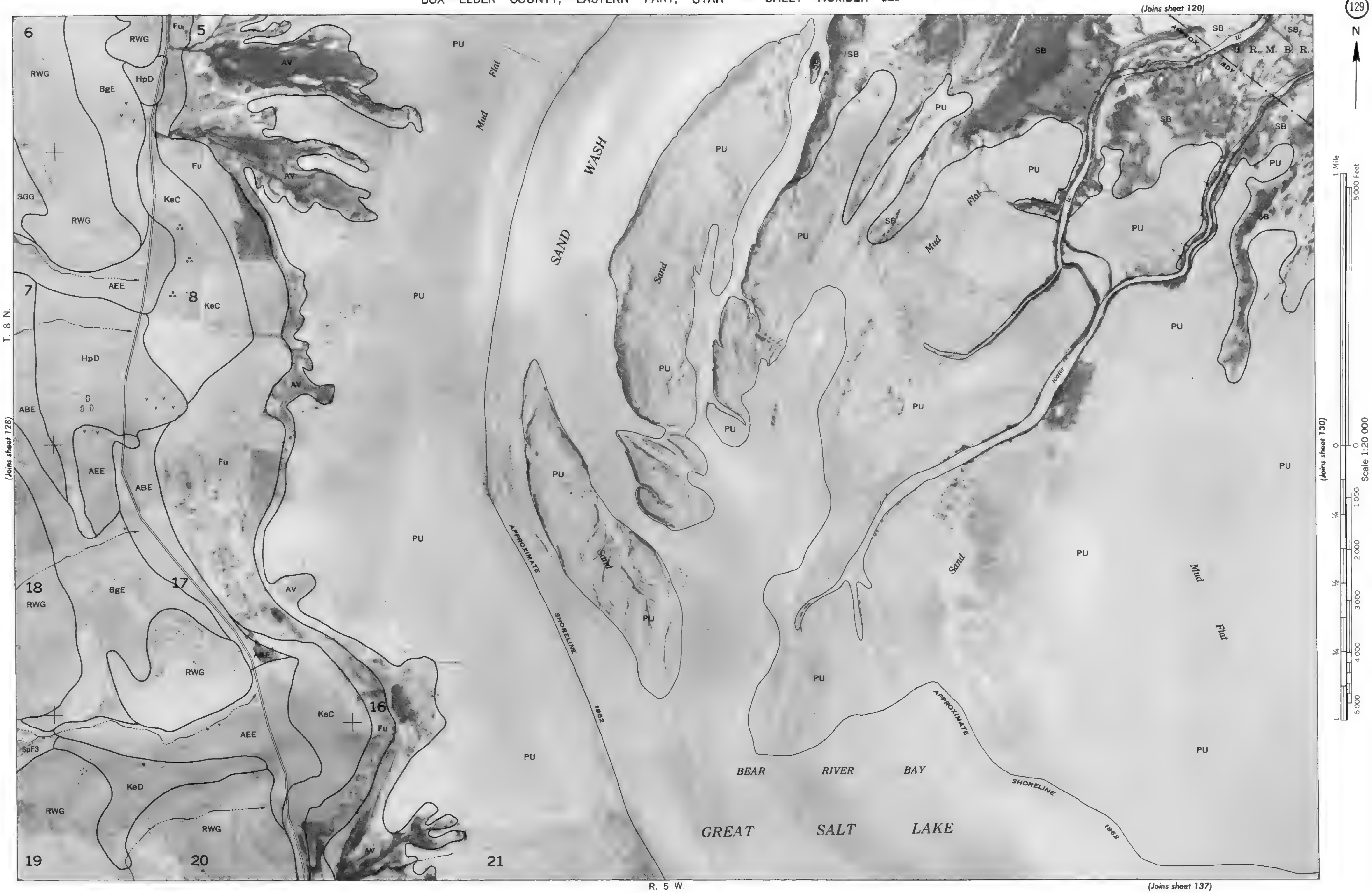
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 128

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 129

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 122)

(Joins sheet 130)

(Joins sheet 132)

(Joins sheet 139)

131

N

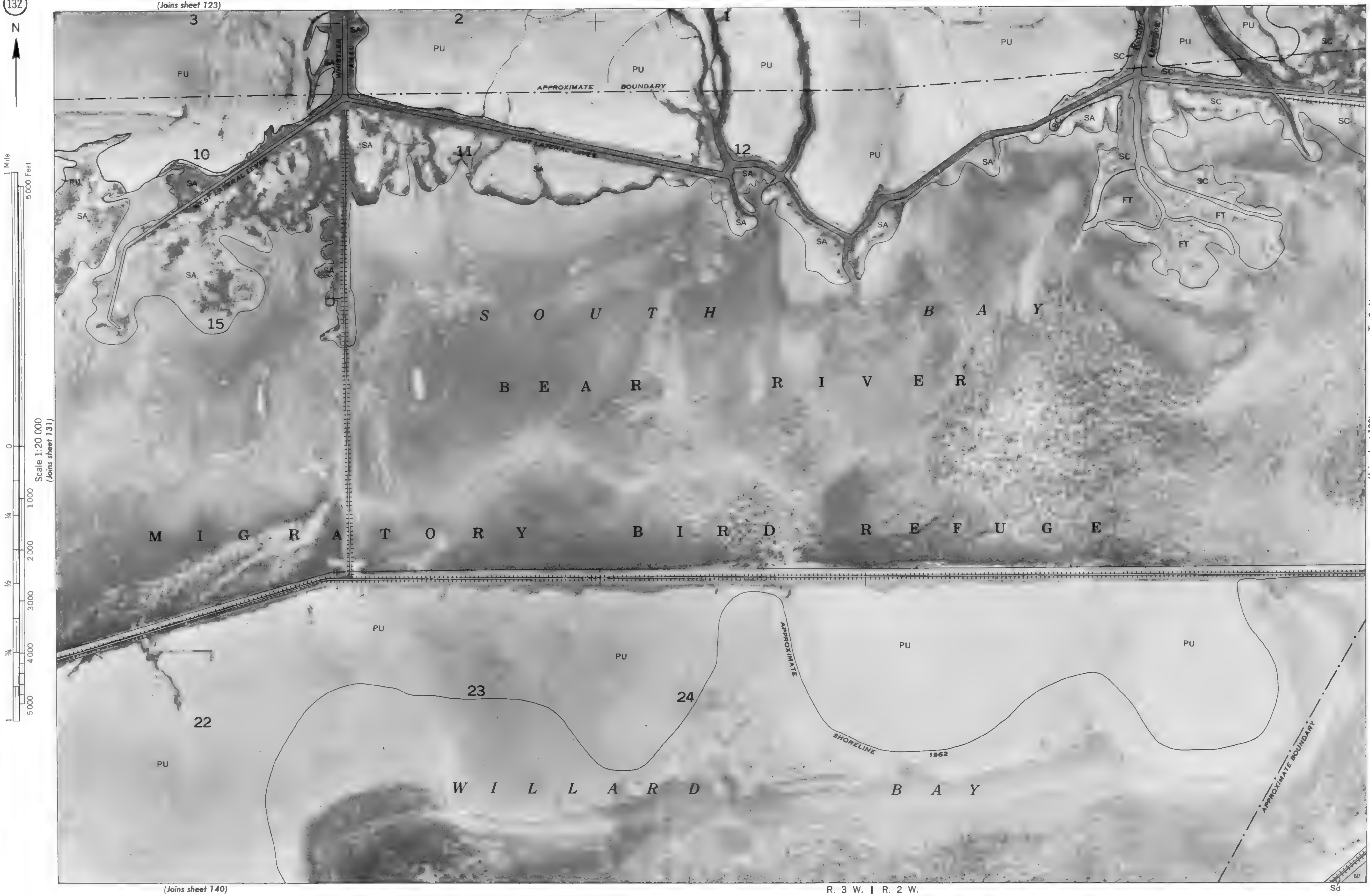
1 Mile
5000 Feet
Scale 1:20 000

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 131

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 132

R. 2 W. | R. 1 W. (Joins sheet 124)

133

N

Scale 1:20 000

1 Mile

5000 Feet

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 133

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 134

(Joins sheet 125)

N

Scale 1:20 000 (Joins sheet 133)

1 Mile 5000 Feet

(Joins sheet 135)

T. 8 N.

R. 1 W.

Land division corners are approximately positioned on this map.

Photobase from 1959 aerial photography.

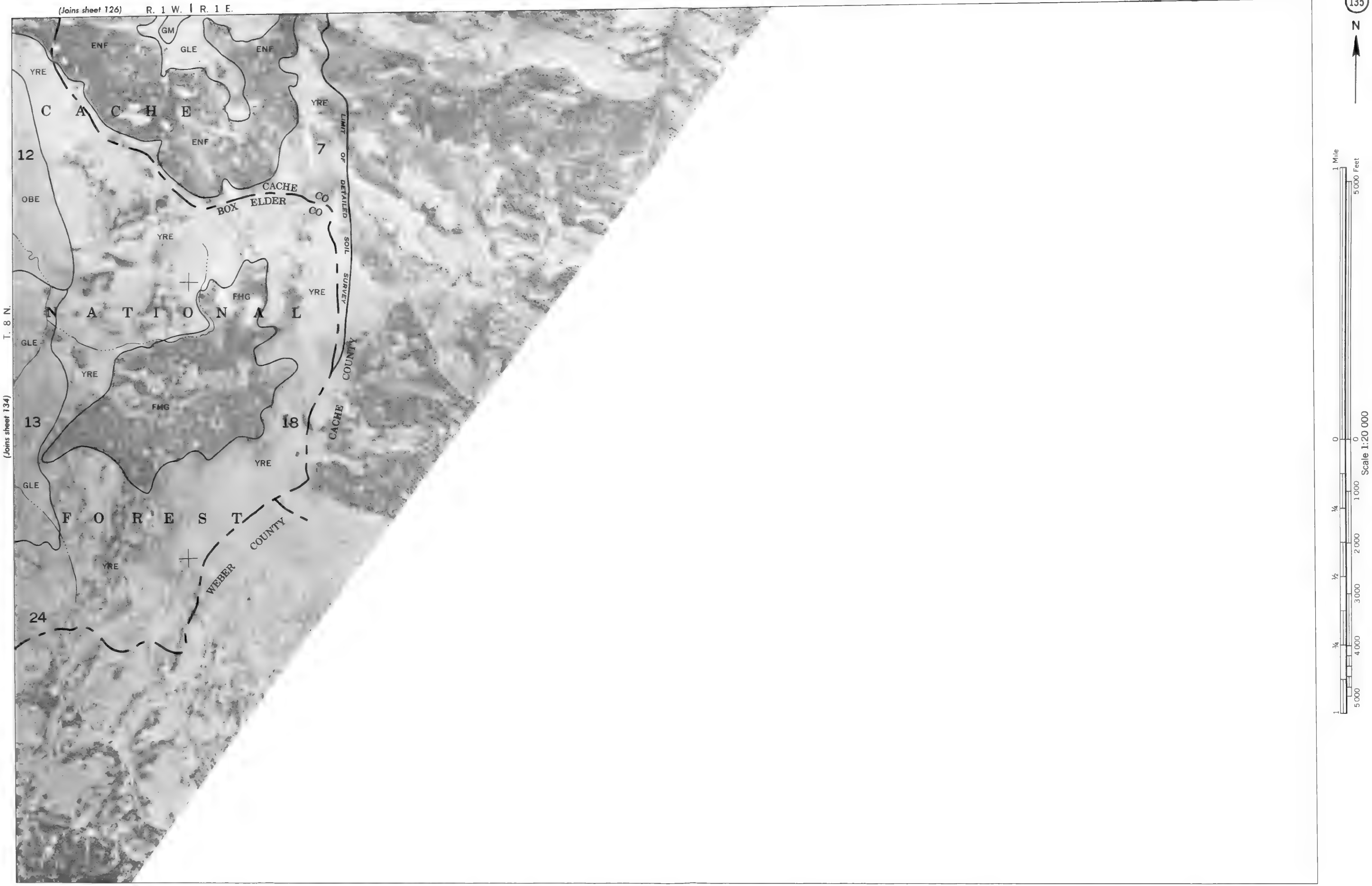
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management; and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 135

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography

Land division corners are approximately positioned on this map.



BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 136

(Joins sheet 128)

R. 6 W. | R. 5 W.

N

(Joins sheet 142)

(Joins sheet 137)

T. 8 N. | T. 7 N.

1 Mile
5 000 Feet
Scale 1:20 000
0
1/4
1/2
3/4
1
0
1 000
2 000
3 000
4 000
5 000

LIMIT OF DETAILED SOIL SURVEY

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 137

(Joins sheet 129)

137

N

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 137

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

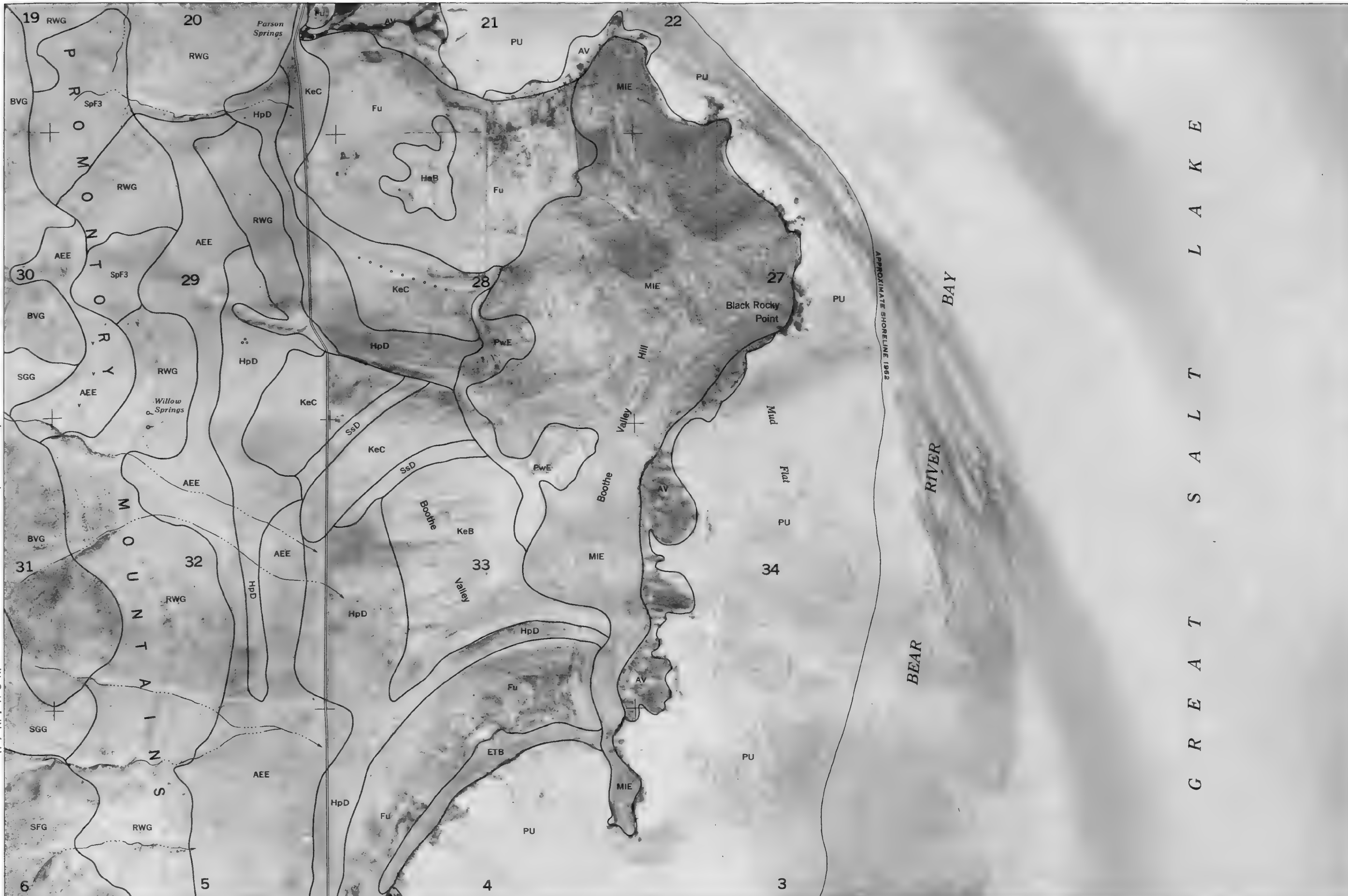
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

(Joins sheet 136)

T. 8 N.

T. 7 N.



R. 5 W.

(Joins sheet 143)

(Joins sheet 138)

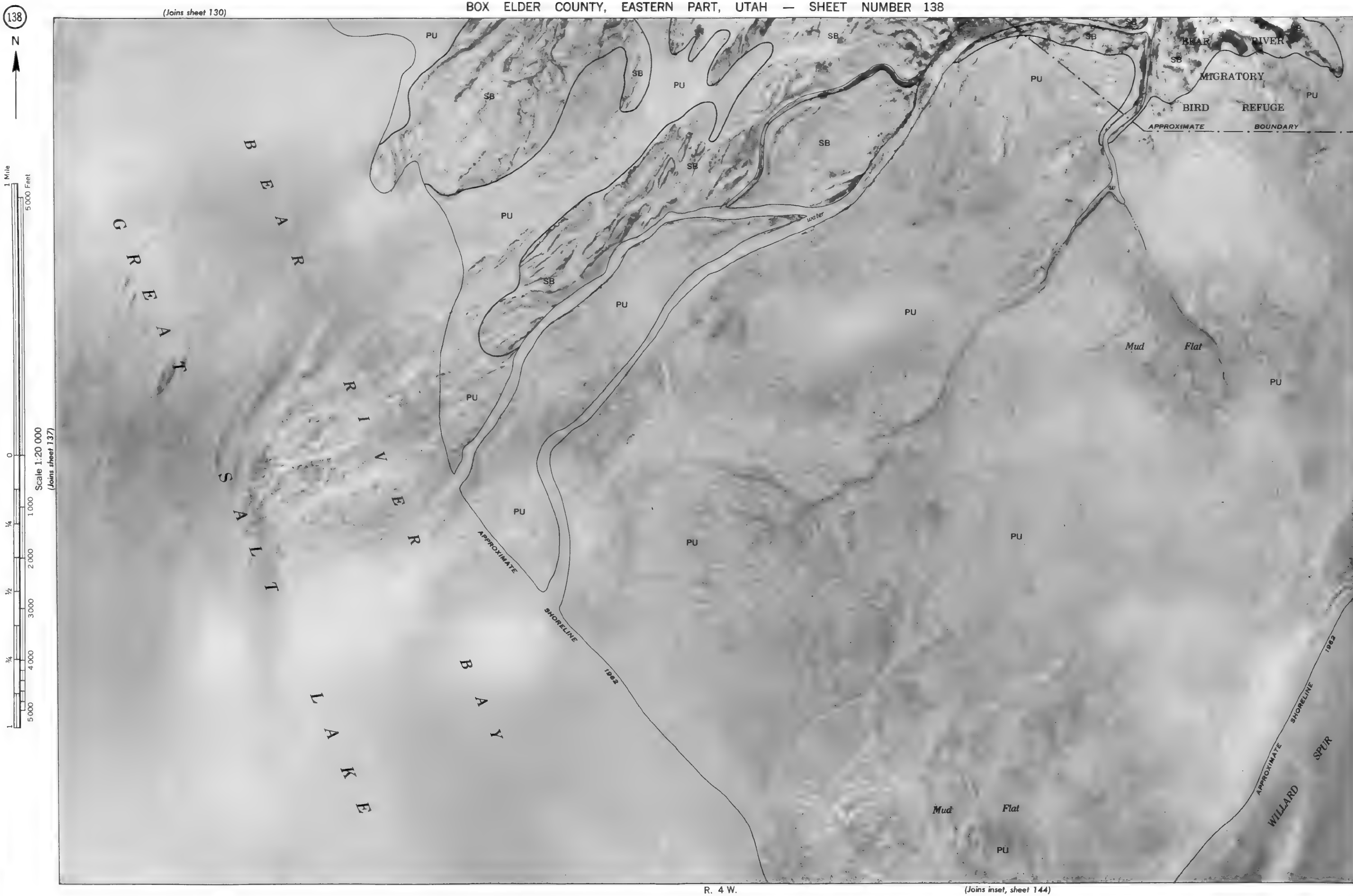
1 Mile

5000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

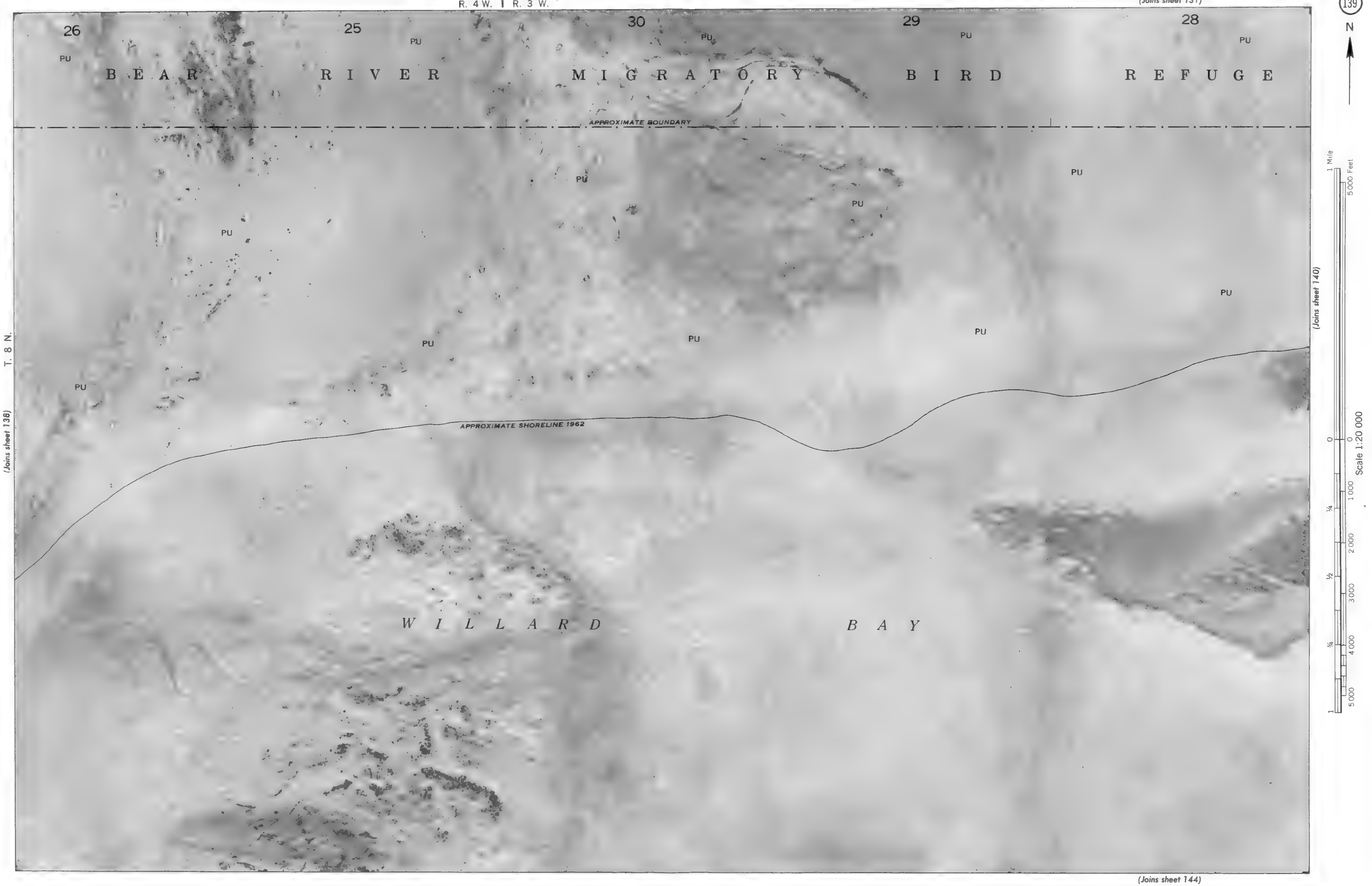
0 1000 2000 3000 4000 5000



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 139



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 139

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 140

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 140

(Joins sheet 133)

141

N

Scale 1:20 000

1 Mile | ¾ | ½ | ¼ | 0

5000 Feet | 4000 | 3000 | 2000 | 1000 | 0

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 141

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

T. 7 N. | T. 8 N.

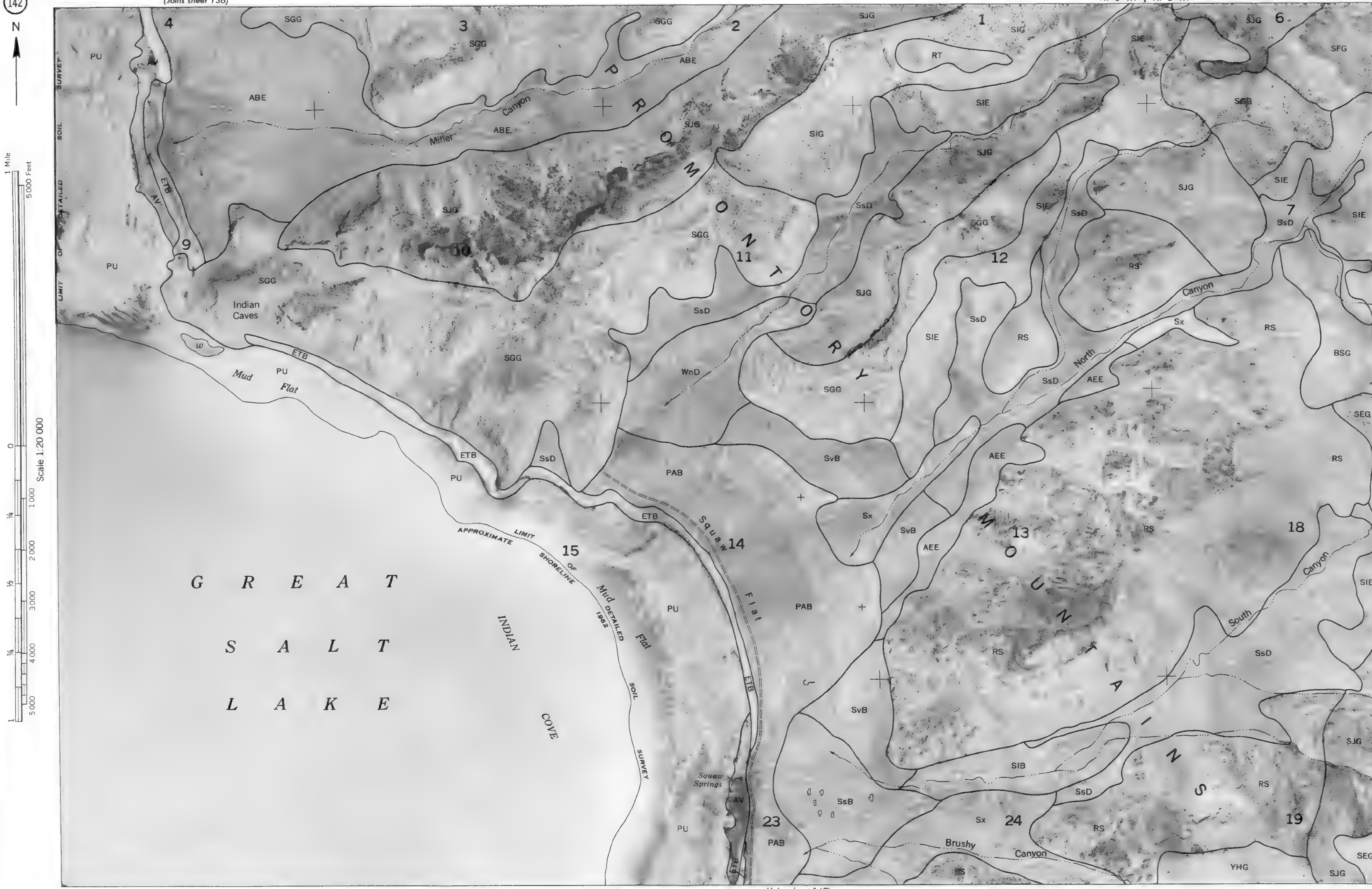
(Joins sheet 140)

(Joins inset, sheet 146)

(Joins sheet 146)

R. 2 W. | R. 1 W.

(Joins sheet 136)



(Joins sheet 143)

(Joins sheet 147)

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

(Joins sheet 137)

143

N

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 143

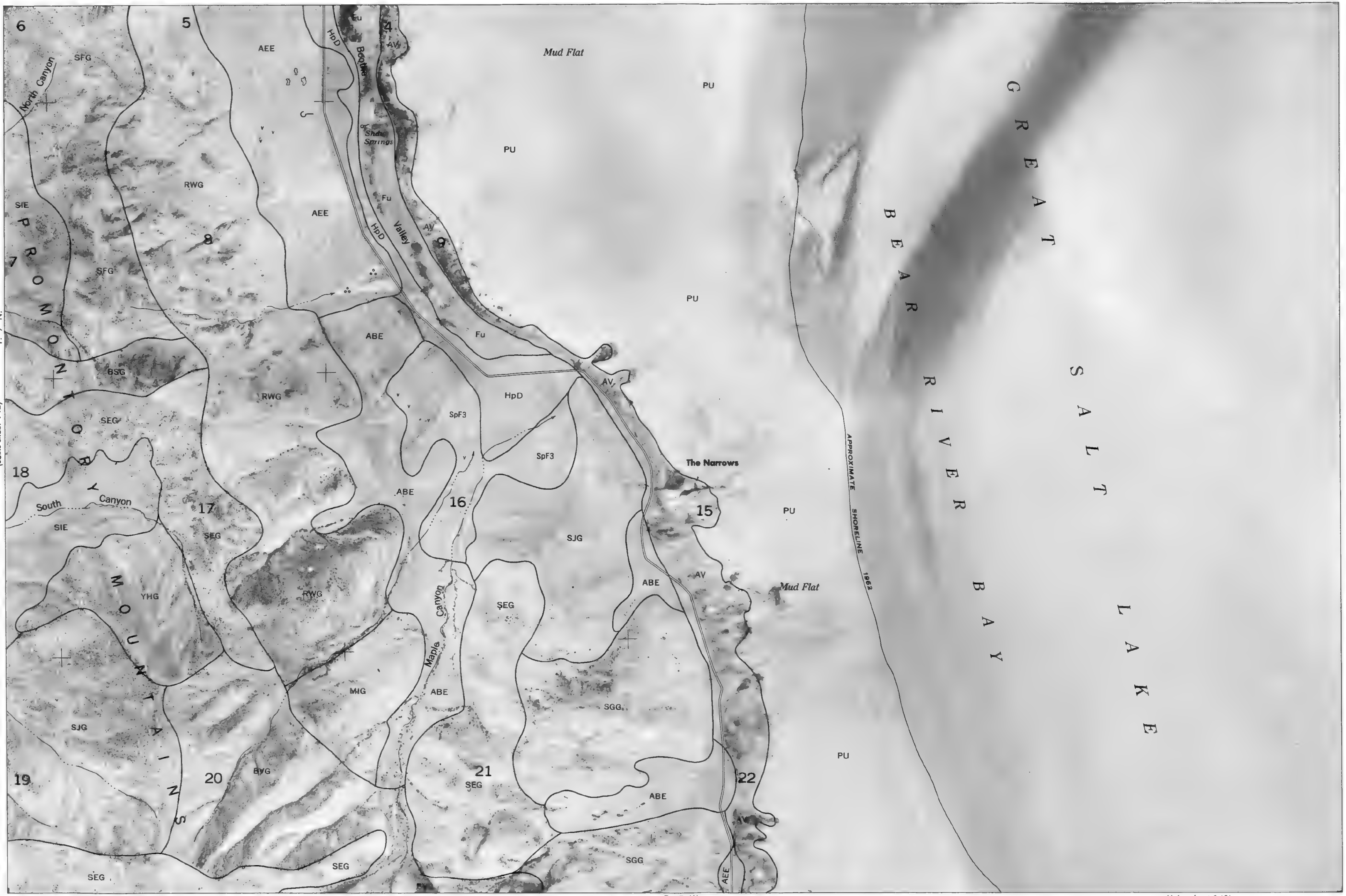
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

T. 7 N.

(Joins sheet 142)



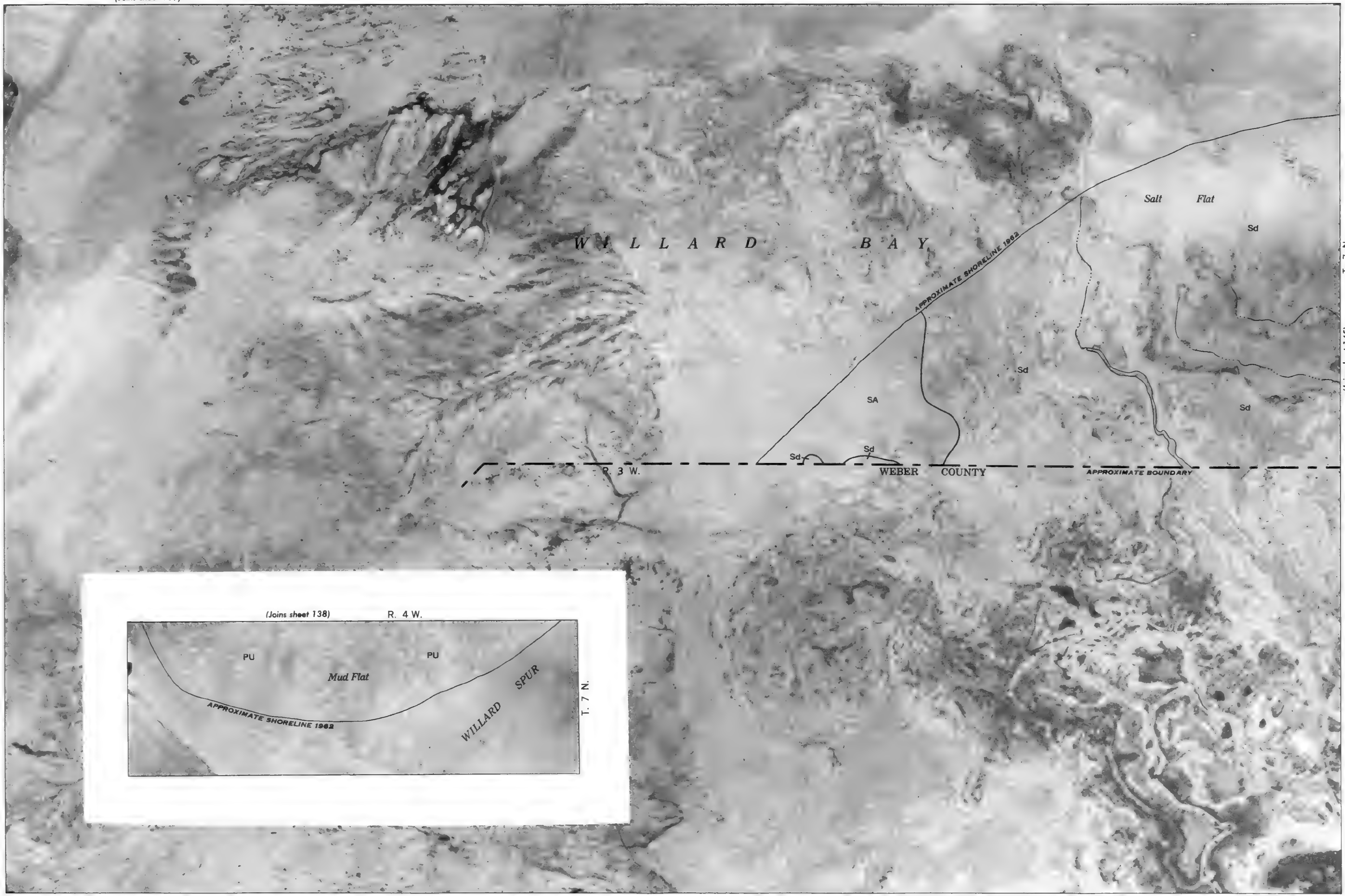
1 Mile
5000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

R. 5 W.

(Joins sheet 148)

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 144

(Joins sheet 139)



(Joins sheet 145)

N

1 Mile
5000 Feet
0
1000
¼
2000
½
3000
¾
4000
5000
1
Scale 1:20 000

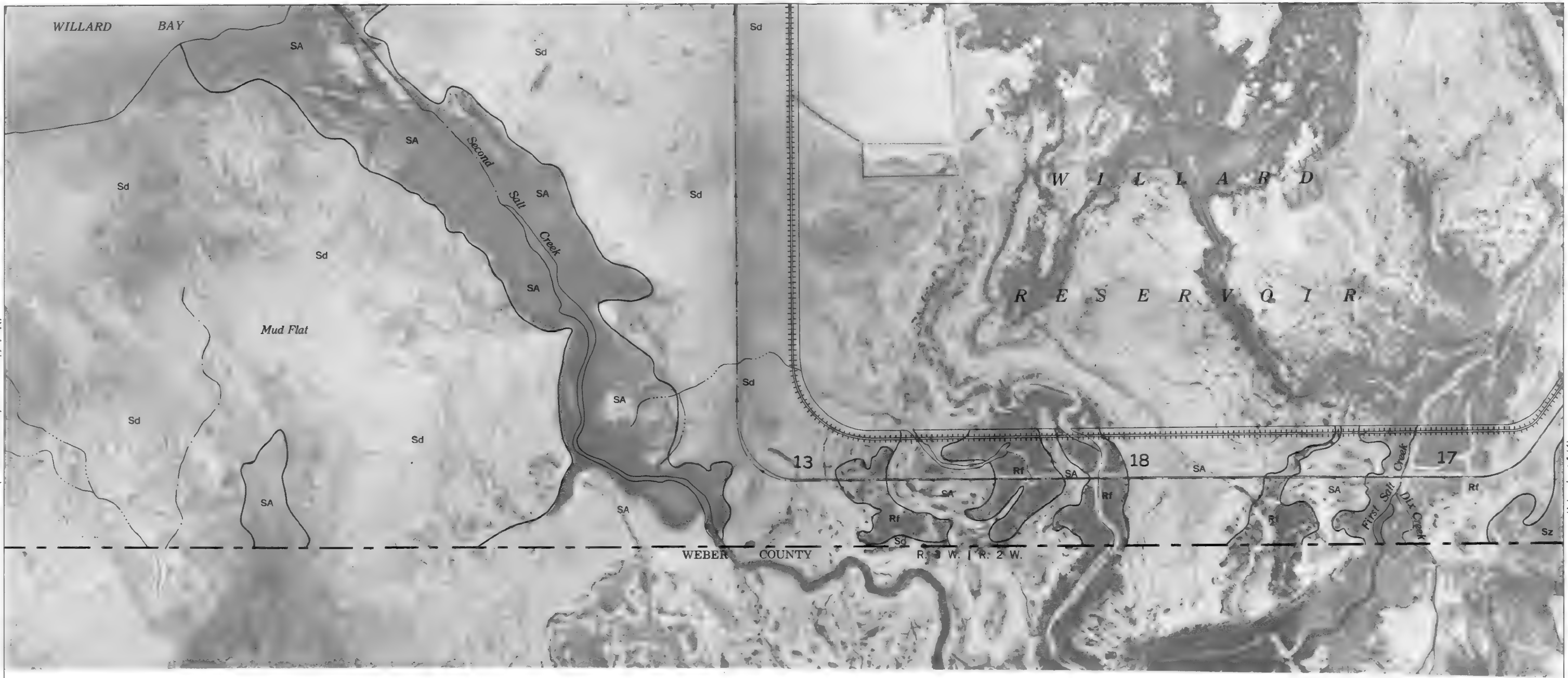
Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 144

(Joins sheet 140)

145

N



(Joins sheet 144)

T. 7 N.

(Joins sheet 146)

1 Mile
5000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

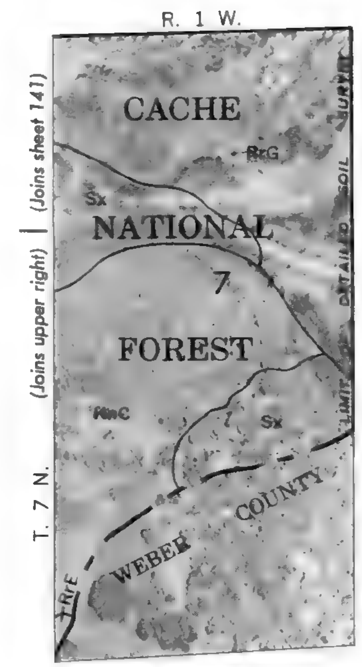
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 145

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

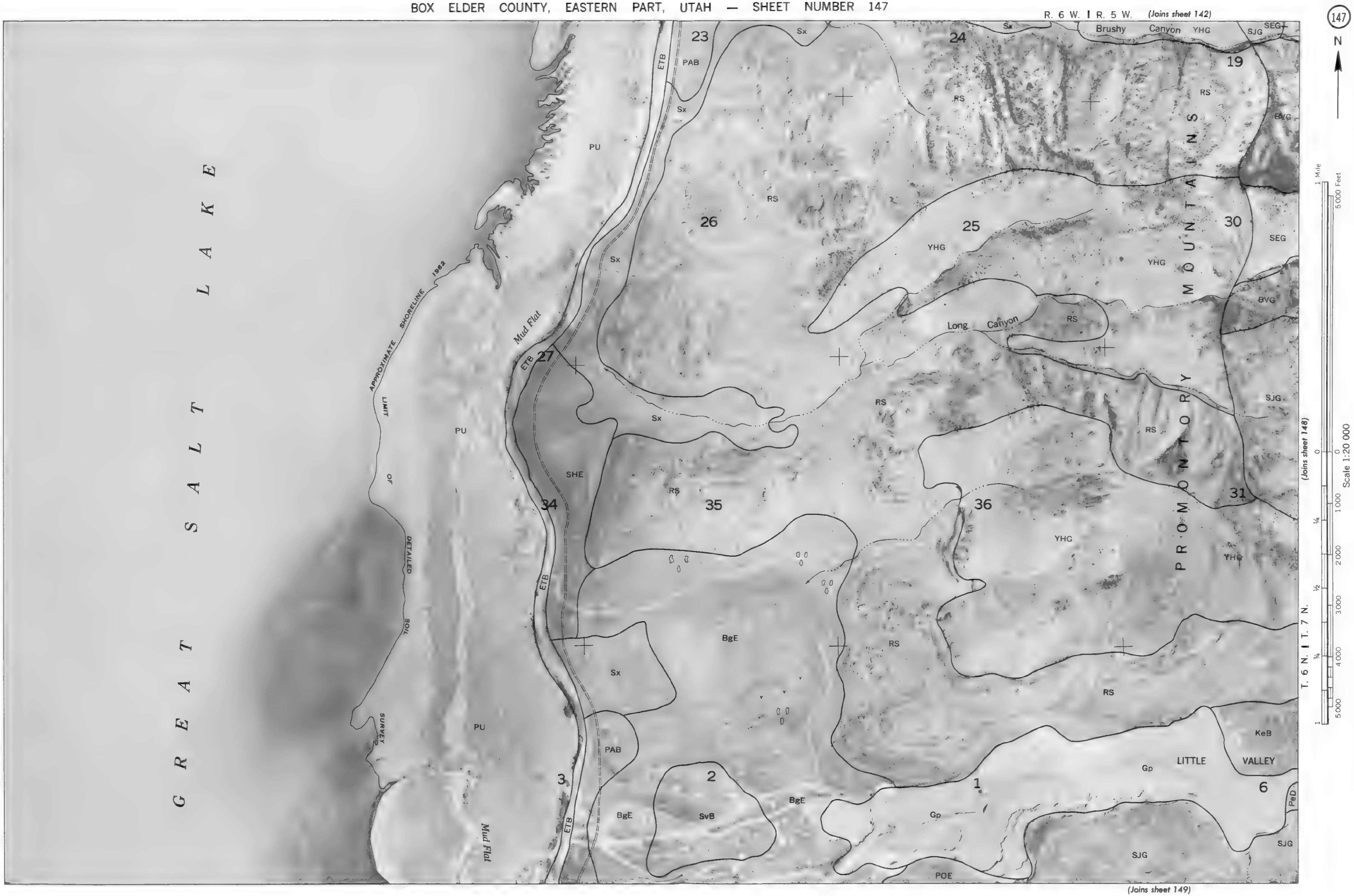
Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 146



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.



BOX ELDER COUNTY, EASTERN PART, UTAH NO. 147

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

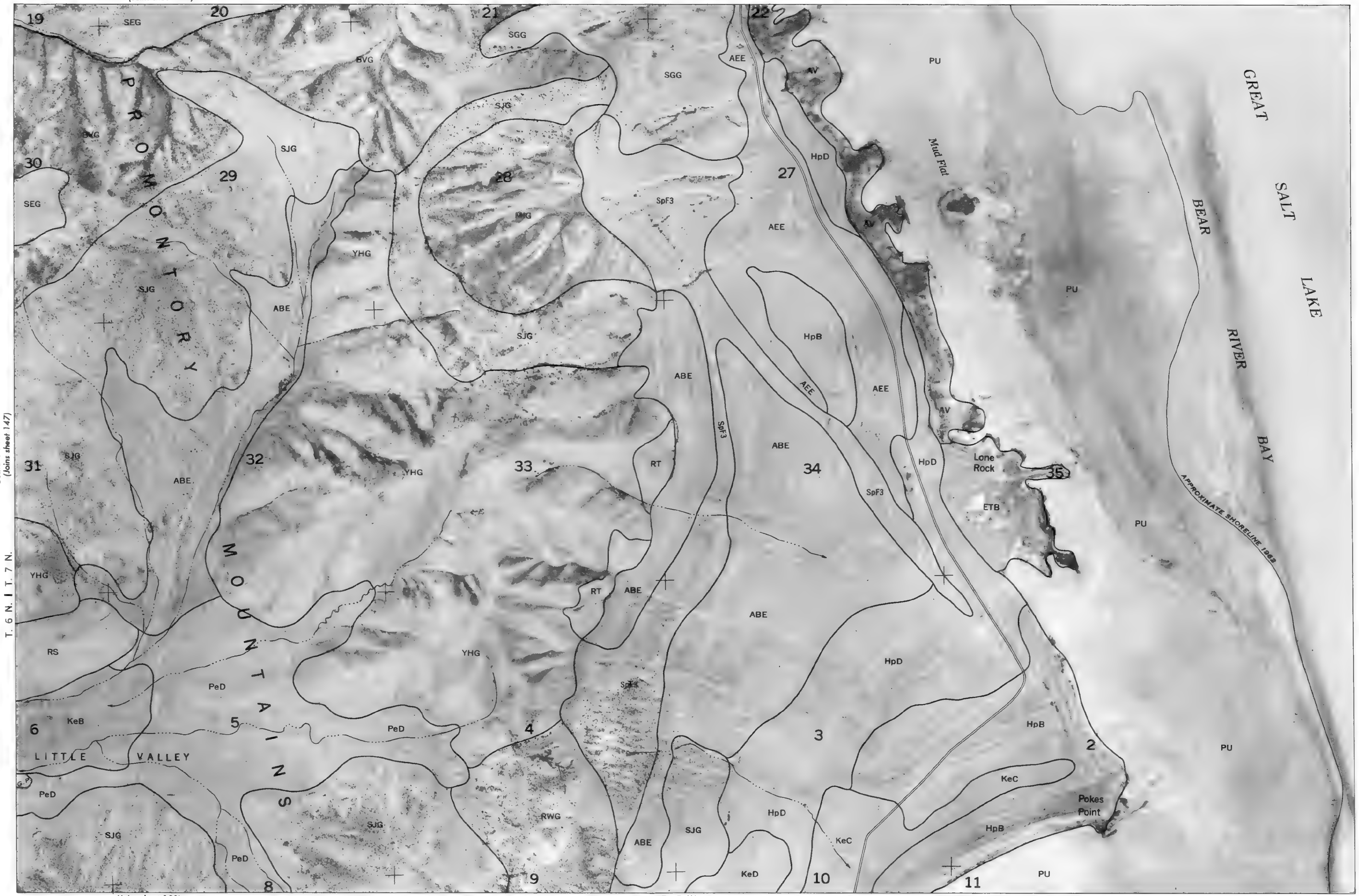
Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 148

N

(Joins sheet 143)

1 Mile
5000 Feet
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1
Scale 1:20 000
(Joins sheet 147)
T. 6 N. | T. 7 N.



(Joins sheet 150)

R. 5 W.

Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 148

(Joins sheet 147)

R. 6 W. | R. 5 W.

149

N

(Joins sheet 150)

Scale 1:20 000

1 Mile

0 ¼ ½ ¾ 1

5000 Feet

0 1000 2000 3000 4000 5000

(Joins inset A, sheet 151) | (Joins sheet 151)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 149

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

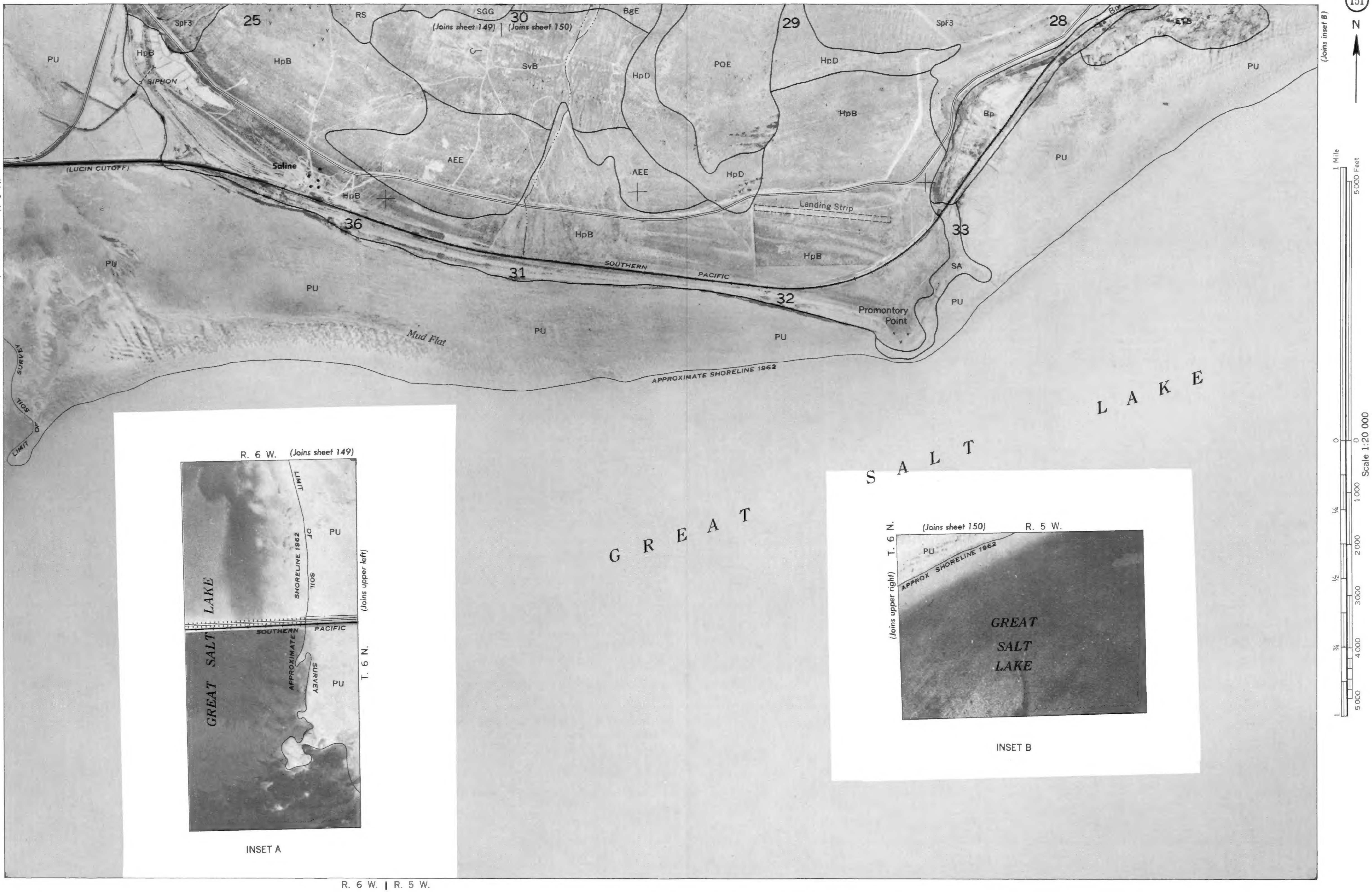
N

(Joins sheet 148)

1 Mile
5 000 Feet
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1
Scale 1:20 000
(Joins sheet 149)
T. 6 N.

R. 5 W.
(Joins sheet 151)
(Joins inset B, sheet 151)

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 150



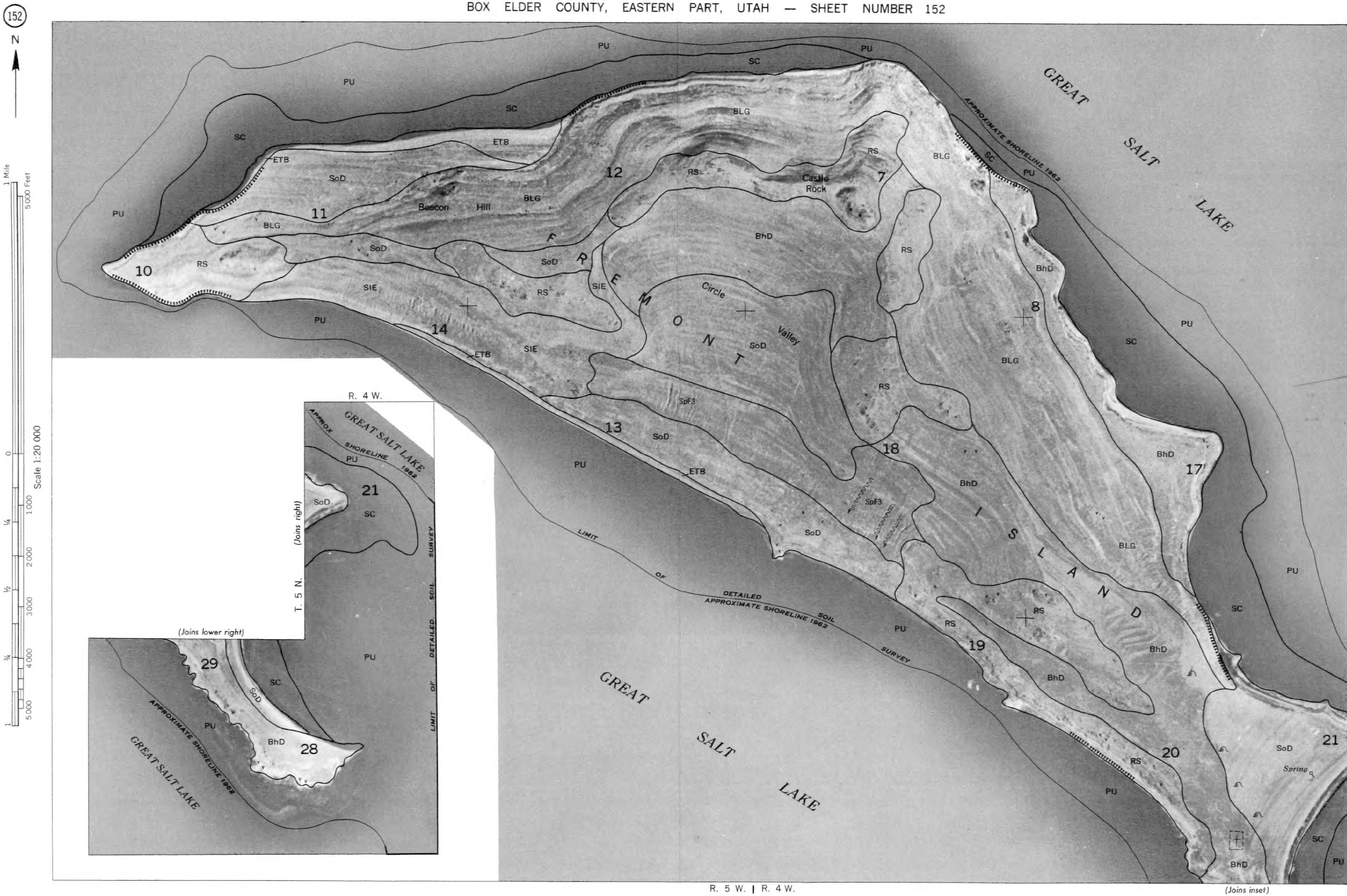
BOX ELDER COUNTY, EASTERN PART, UTAH NO. 151

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

Photobase from 1959 aerial photography.

Land division corners are approximately positioned on this map.

BOX ELDER COUNTY, EASTERN PART, UTAH — SHEET NUMBER 152



Land division corners are approximately positioned on this map.
Photobase from 1959 aerial photography.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the United States Department of Interior, Bureau of Sport Fisheries and Wildlife and Bureau of Land Management, and the Utah Agricultural Experiment Station.

BOX ELDER COUNTY, EASTERN PART, UTAH NO. 152